



US009554835B2

(12) **United States Patent**
Brinkman et al.

(10) **Patent No.:** **US 9,554,835 B2**
(45) **Date of Patent:** **Jan. 31, 2017**

(54) **SURGICAL IMPLANT SYSTEM AND METHOD**
(71) Applicant: **Warsaw Orthopedic, Inc.**, Warsaw, IN (US)
(72) Inventors: **Jennifer G. Brinkman**, Memphis, TN (US); **Nicholas M. Benson**, Cordova, TN (US); **David W. Harwood**, Memphis, TN (US); **Larry Thomas McBride, Jr.**, Memphis, TN (US)

7,462,182 B2 12/2008 Lim
7,476,240 B2 1/2009 Raymond et al.
7,481,813 B1 1/2009 Purcell
7,520,879 B2 4/2009 Justis et al.
7,563,274 B2 7/2009 Justis et al.
7,572,276 B2 8/2009 Lim et al.
7,597,694 B2 10/2009 Lim et al.
7,648,507 B2 1/2010 Techiera et al.
7,686,809 B2 3/2010 Triplett et al.
7,695,475 B2 4/2010 Justis et al.
7,758,584 B2 7/2010 Bankoski et al.
7,871,424 B2 1/2011 Abdelgany

(Continued)

(73) Assignee: **Warsaw Orthopedic, Inc.**, Warsaw, IN (US)

FOREIGN PATENT DOCUMENTS

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 140 days.

DE 10032126 A1 1/2002
EP 1916954 A2 5/2008

(Continued)

(21) Appl. No.: **13/827,485**

OTHER PUBLICATIONS

(22) Filed: **Mar. 14, 2013**

International Search Report and Written Opinion for PCT/US2014/025338, the counterpart application mailed on Jul. 11, 2014.

(65) **Prior Publication Data**

US 2014/0277166 A1 Sep. 18, 2014

Primary Examiner — Eduardo C Robert
Assistant Examiner — Julianna N Harvey

(51) **Int. Cl.**
A61B 17/70 (2006.01)

(52) **U.S. Cl.**
CPC **A61B 17/7085** (2013.01); **A61B 17/7083** (2013.01); **A61B 17/7086** (2013.01); **A61B 17/7088** (2013.01); **A61B 17/7004** (2013.01)

(57) **ABSTRACT**

(58) **Field of Classification Search**
CPC A61B 17/7083; A61B 17/7085; A61B 17/7086; A61B 17/7088; A61B 17/7089
See application file for complete search history.

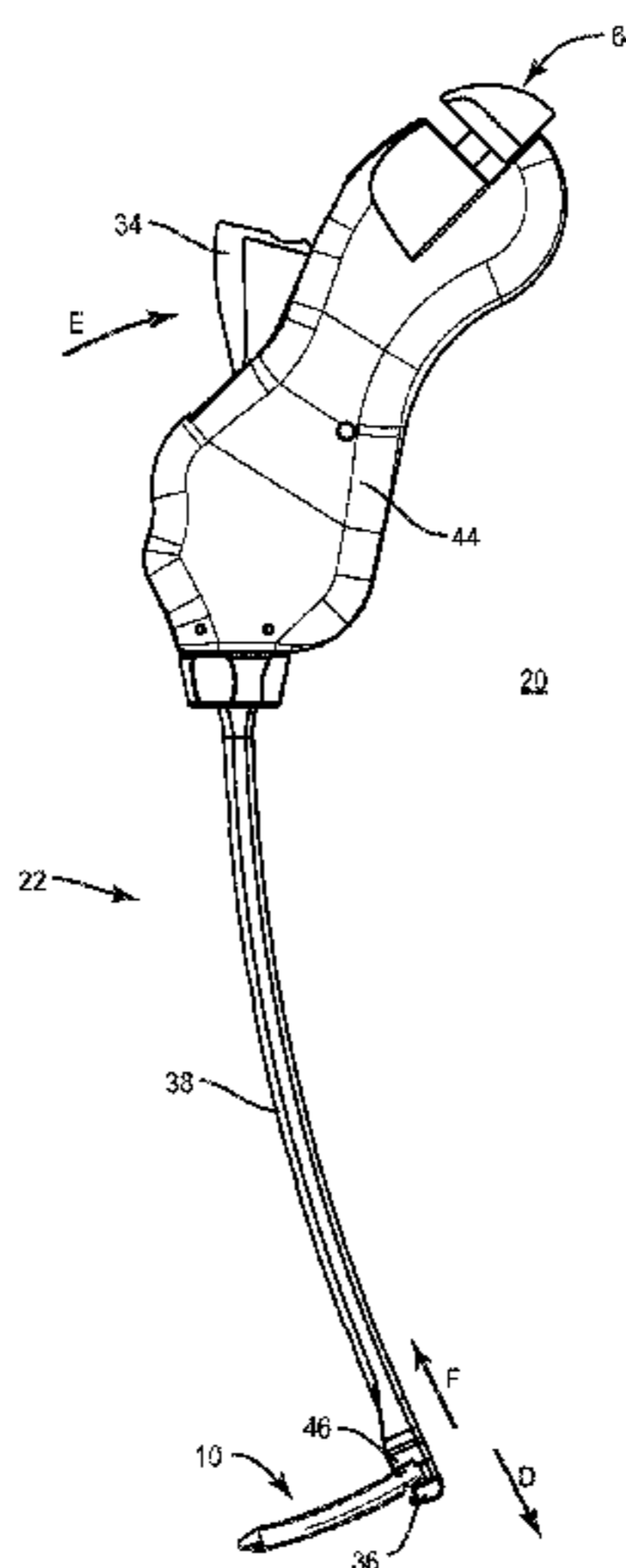
A surgical instrument comprises a body. A first member extends between a first end and a second end. A second member extends between a first end connected with the body and a second end. A third member is connected to the first end of the first member and the body to relatively axially translate the second ends. The third member includes a latch and a lock engageable with the latch. The latch is disposable in a locking orientation and a non-locking orientation. Systems and methods of use are disclosed.

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,755,338 B2 6/2004 Hahnen et al.
7,371,239 B2 5/2008 Dec et al.

20 Claims, 19 Drawing Sheets



(56)

References Cited

U.S. PATENT DOCUMENTS

7,914,558 B2 3/2011 Landry et al.
 7,998,144 B2 8/2011 Schumacher et al.
 8,025,682 B2 9/2011 Mahoney et al.
 8,043,343 B2 10/2011 Miller et al.
 8,075,592 B2 12/2011 Landry et al.
 8,100,951 B2 1/2012 Justis et al.
 8,142,437 B2 3/2012 McLean et al.
 8,167,887 B2 5/2012 McLean
 8,192,439 B2 6/2012 Songer et al.
 8,206,394 B2 6/2012 Stad et al.
 8,226,656 B2 7/2012 McBride
 8,246,624 B2 8/2012 Forton et al.
 8,308,728 B2 11/2012 Iott et al.
 8,348,954 B2 1/2013 Carls et al.
 8,366,714 B2 2/2013 Jones et al.
 8,460,301 B2 6/2013 Fiorella
 2005/0192589 A1 9/2005 Raymond et al.
 2005/0228392 A1 10/2005 Keyer et al.
 2007/0078460 A1 4/2007 Frigg et al.
 2007/0123904 A1 5/2007 Stad et al.
 2007/0213714 A1 9/2007 Justis et al.
 2008/0121234 A1 5/2008 Ho et al.
 2008/0269764 A1 10/2008 Blain et al.

2008/0269805 A1 10/2008 Dekutoski et al.
 2008/0312703 A1 12/2008 Hestad et al.
 2009/0198281 A1 8/2009 Rice et al.
 2010/0036443 A1 2/2010 Hutton et al.
 2010/0249856 A1 9/2010 Iott et al.
 2011/0077690 A1 3/2011 Shin et al.
 2011/0093014 A1 4/2011 Davis et al.
 2011/0166610 A1 7/2011 Altarac et al.
 2011/0184464 A1 7/2011 Fiorella
 2011/0196426 A1 8/2011 Peukert et al.
 2011/0202096 A1 8/2011 White et al.
 2011/0313470 A1* 12/2011 McLean A61B 17/7011
 606/305
 2012/0029580 A1 2/2012 Solitario, Jr.
 2012/0053643 A1 3/2012 Harper
 2012/0271355 A1 10/2012 Steele et al.
 2013/0018423 A1 1/2013 Stad et al.

FOREIGN PATENT DOCUMENTS

EP 2111809 A2 10/2009
 KR 2008059920 A1 7/2008
 KR 2009072327 A1 7/2009
 KR 1001539 A1 12/2010
 KR 2011029988 A1 3/2011

* cited by examiner

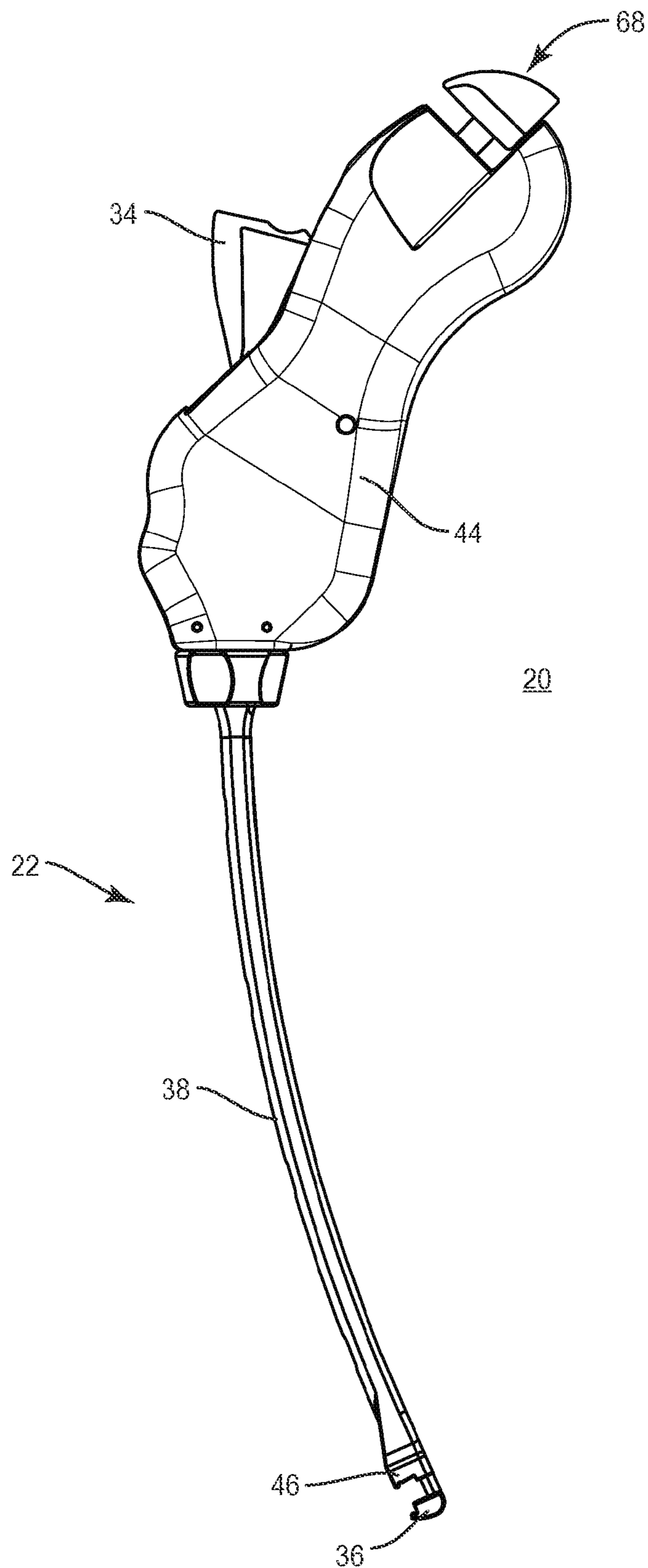


FIG. 1

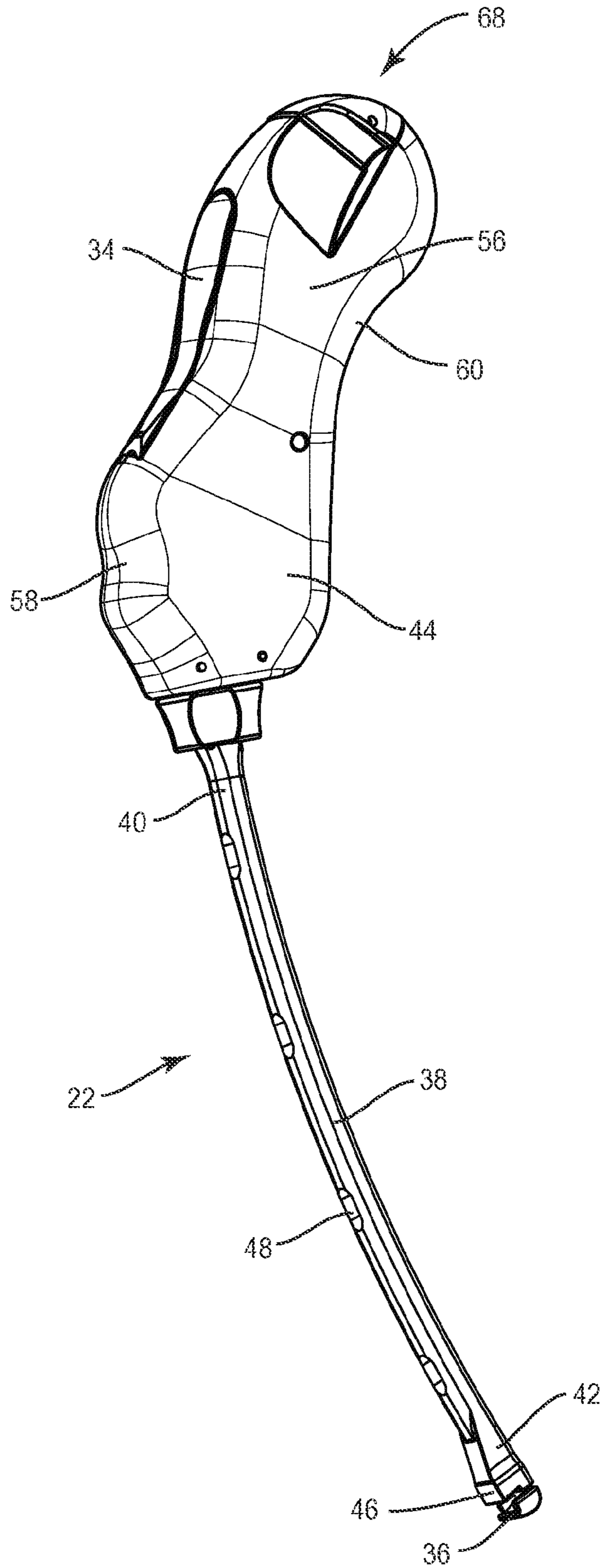


FIG. 2

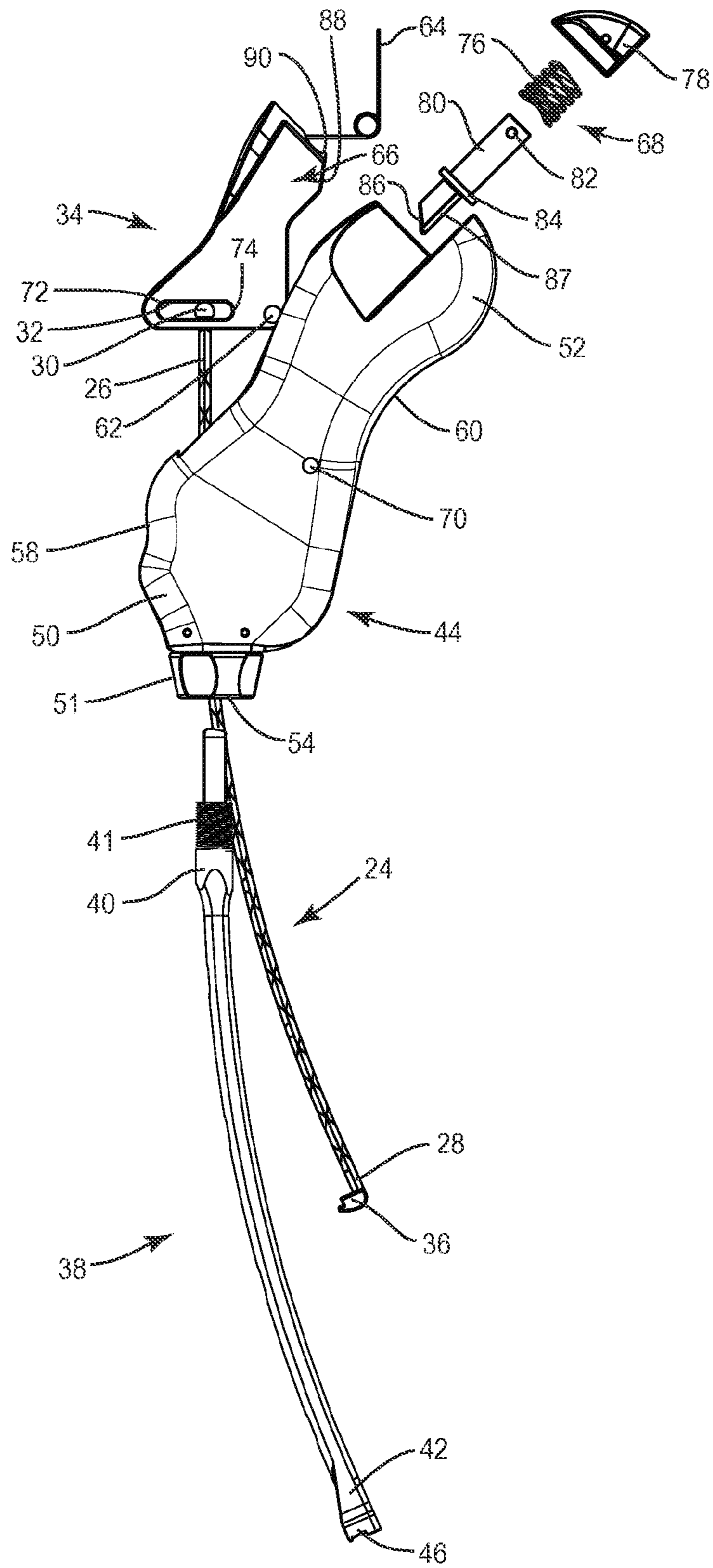


FIG. 3

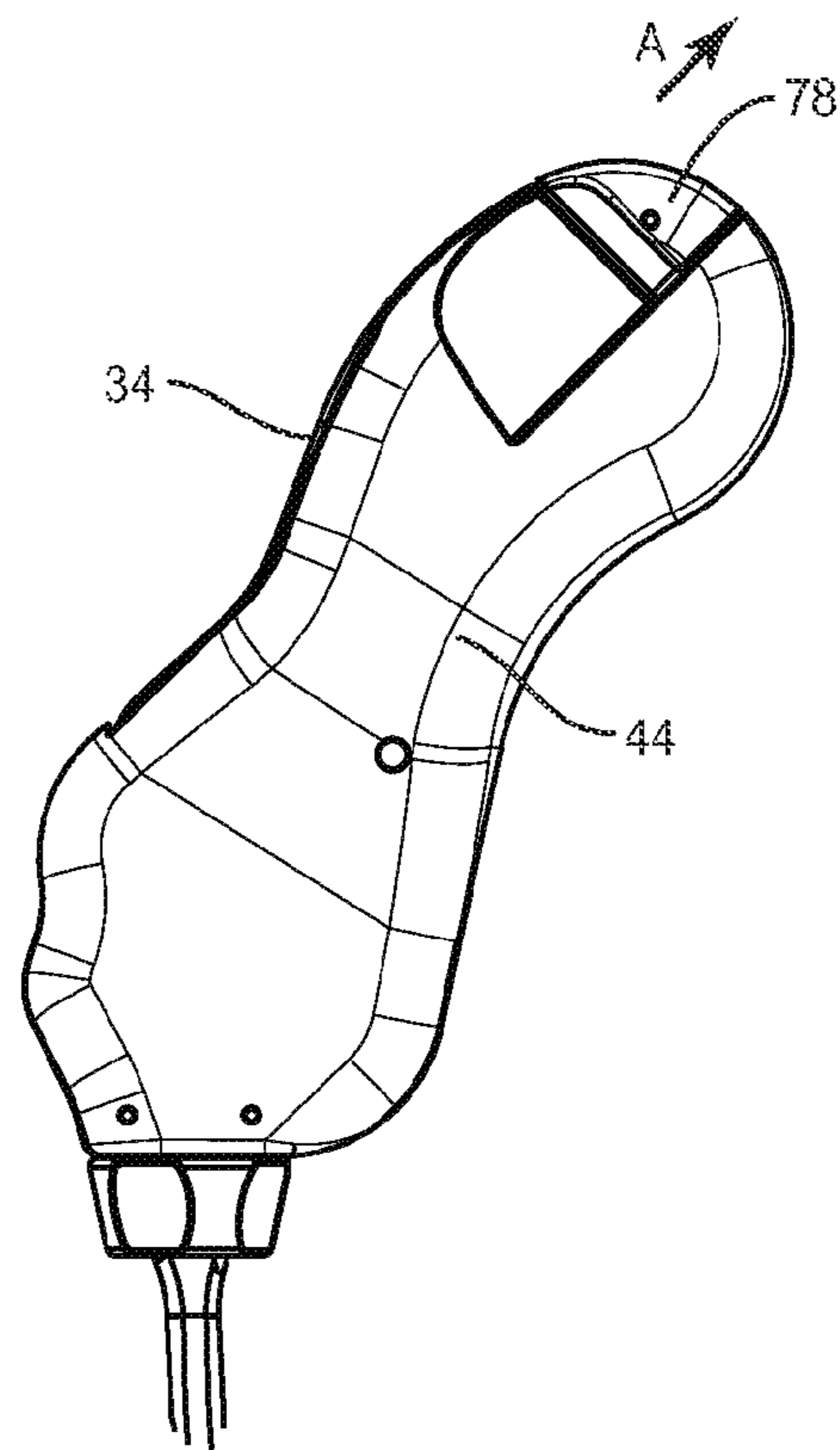


FIG. 4

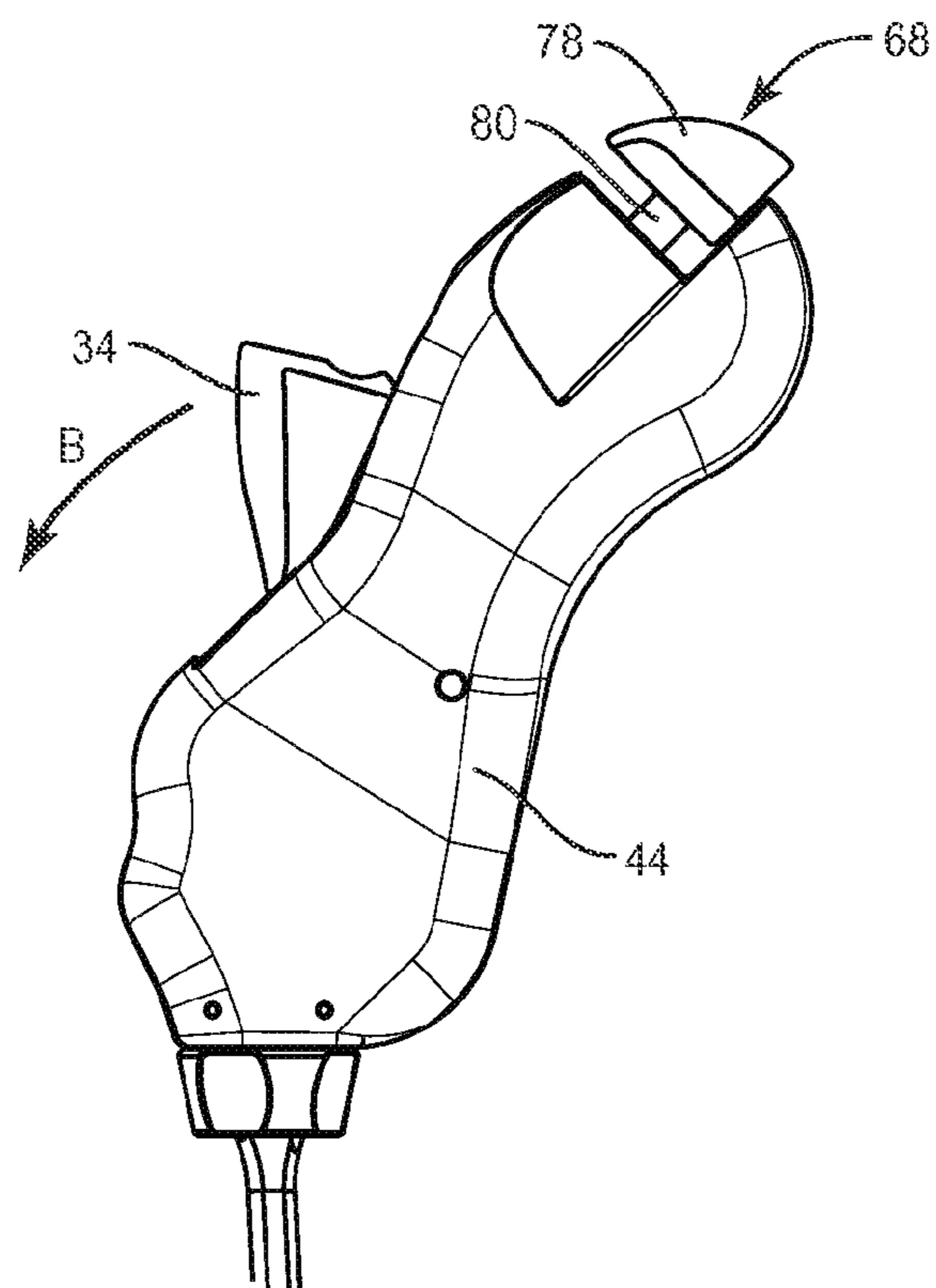


FIG. 5

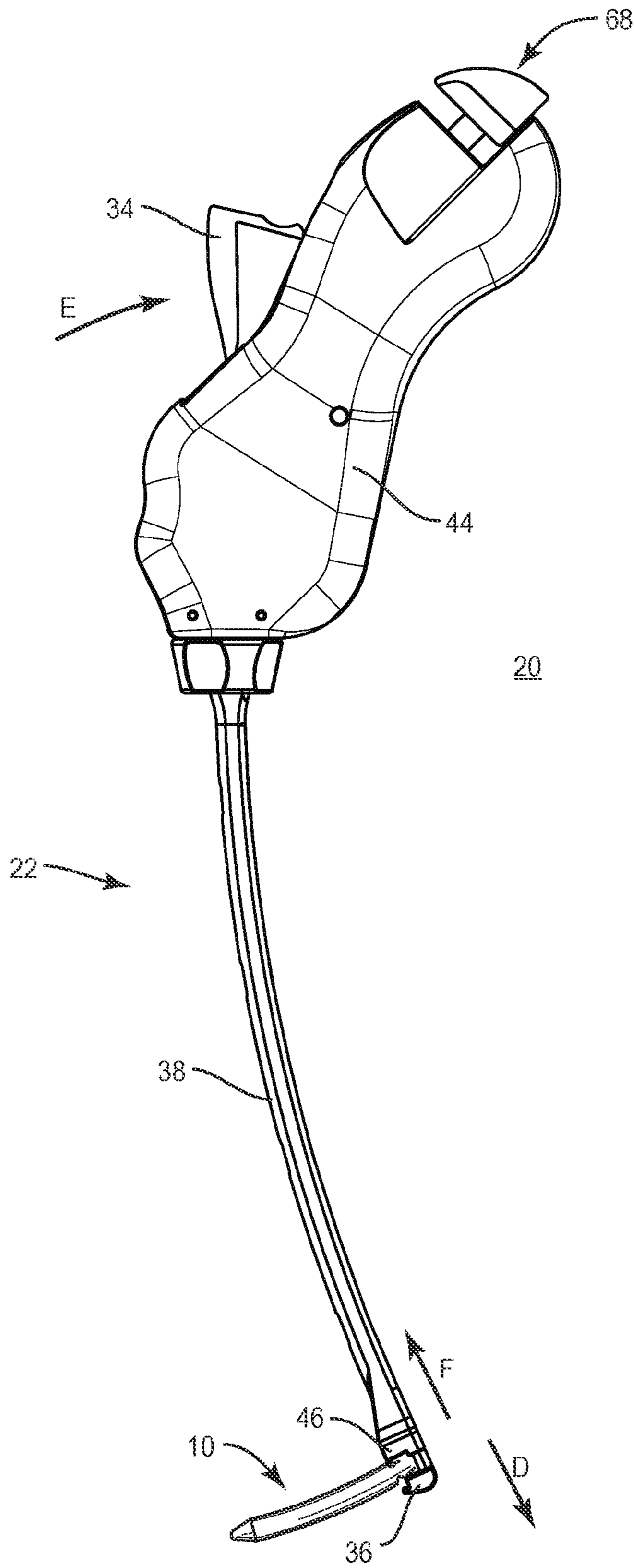


FIG. 6

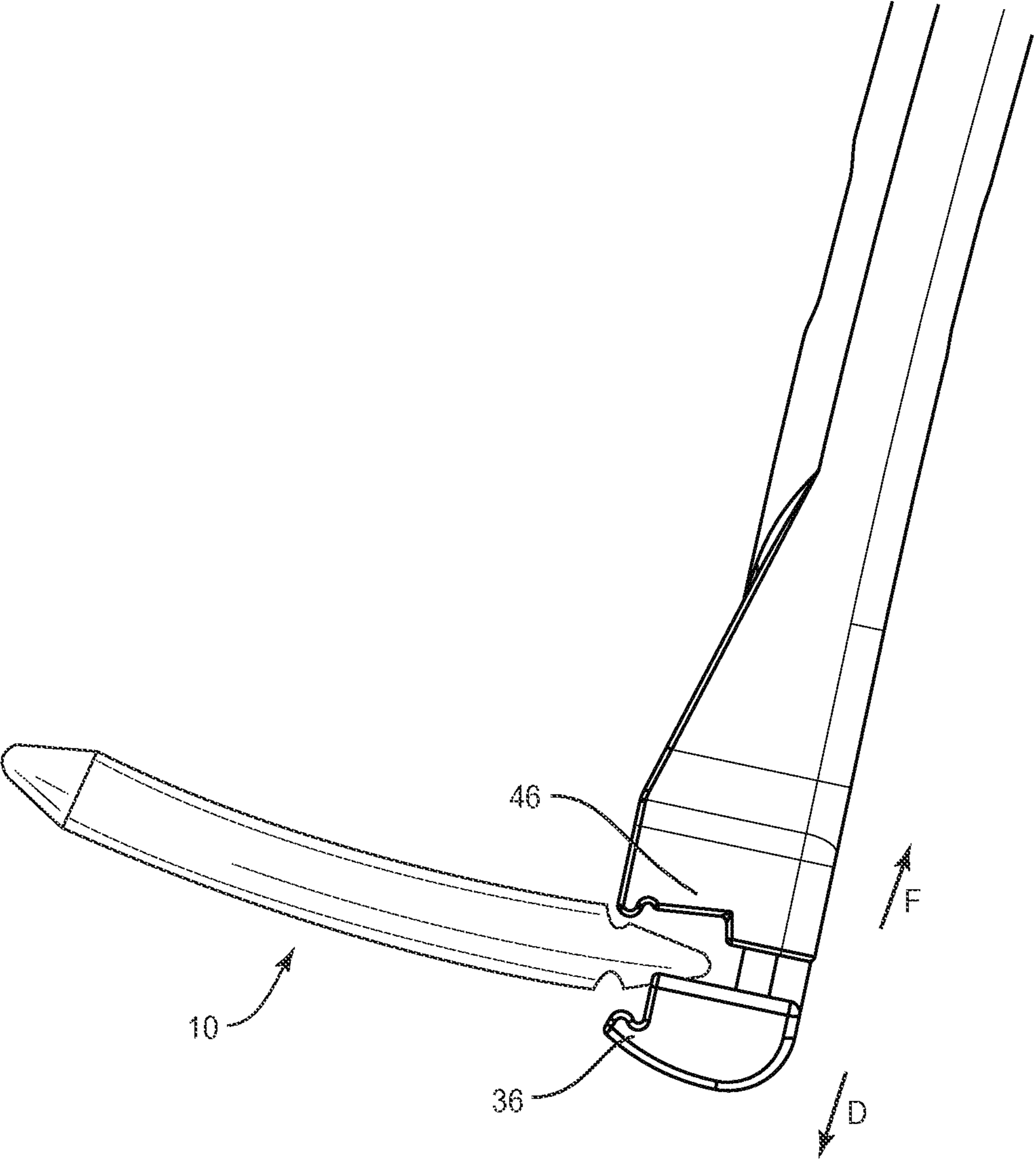


FIG. 7

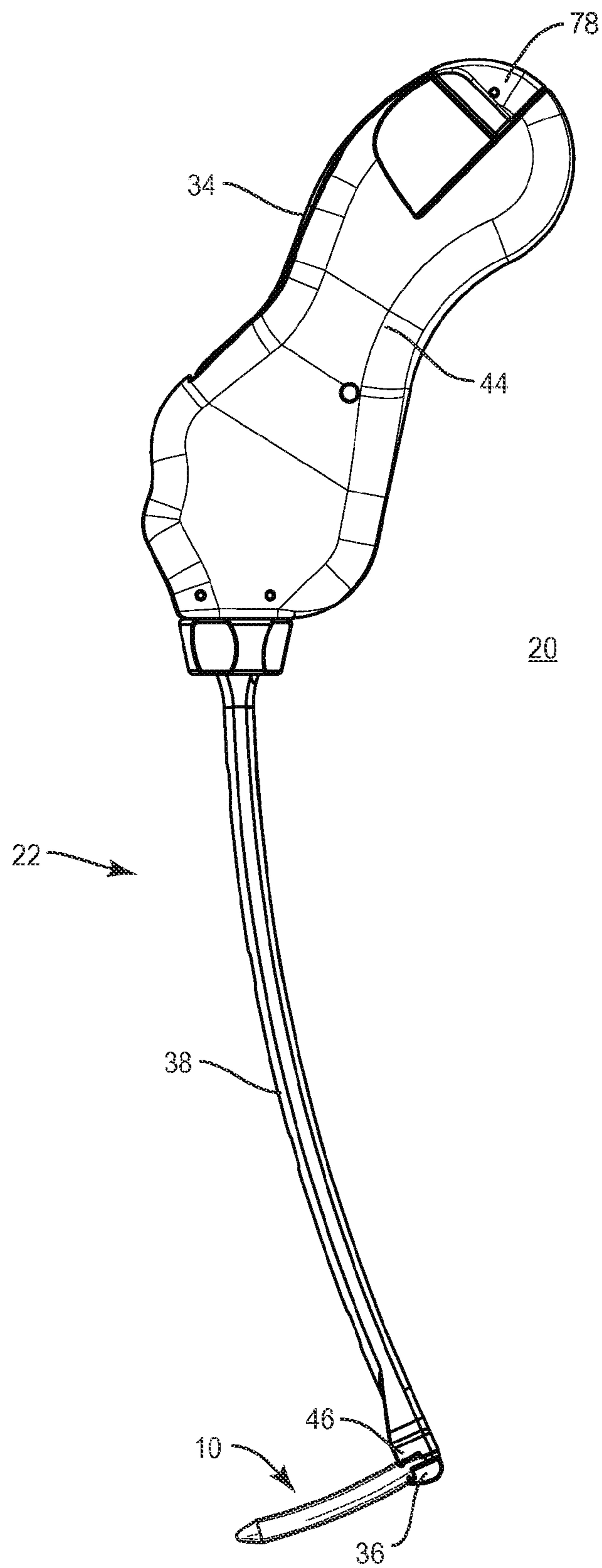


FIG. 8

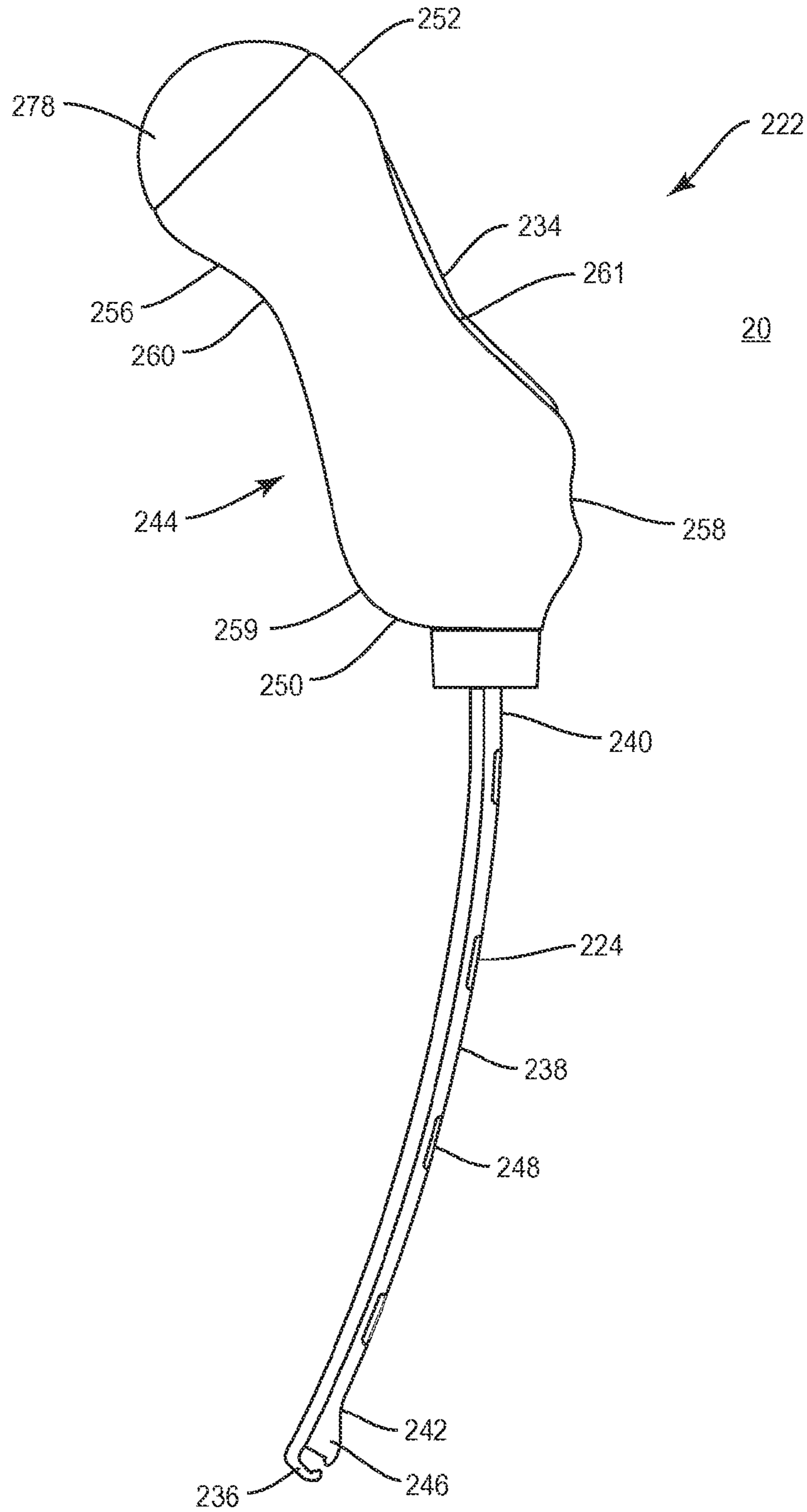


FIG. 9

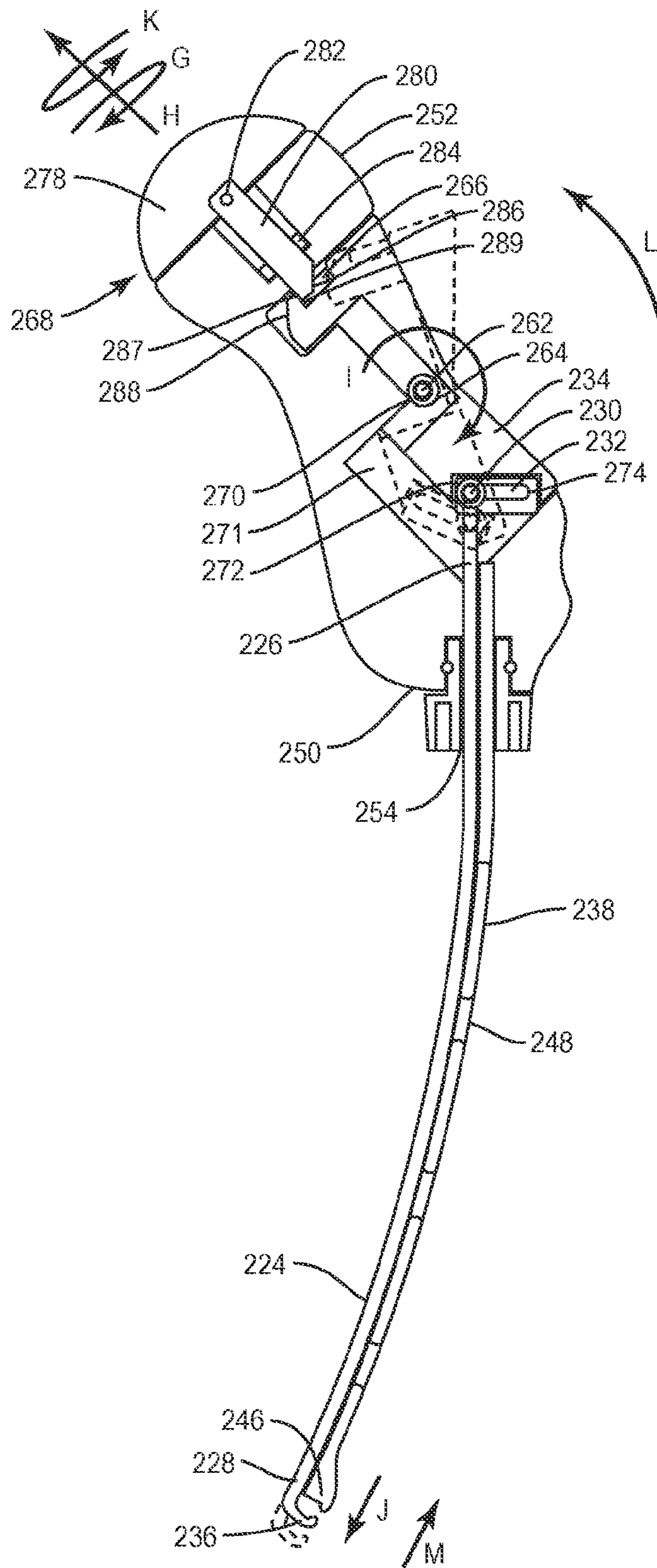


FIG. 10

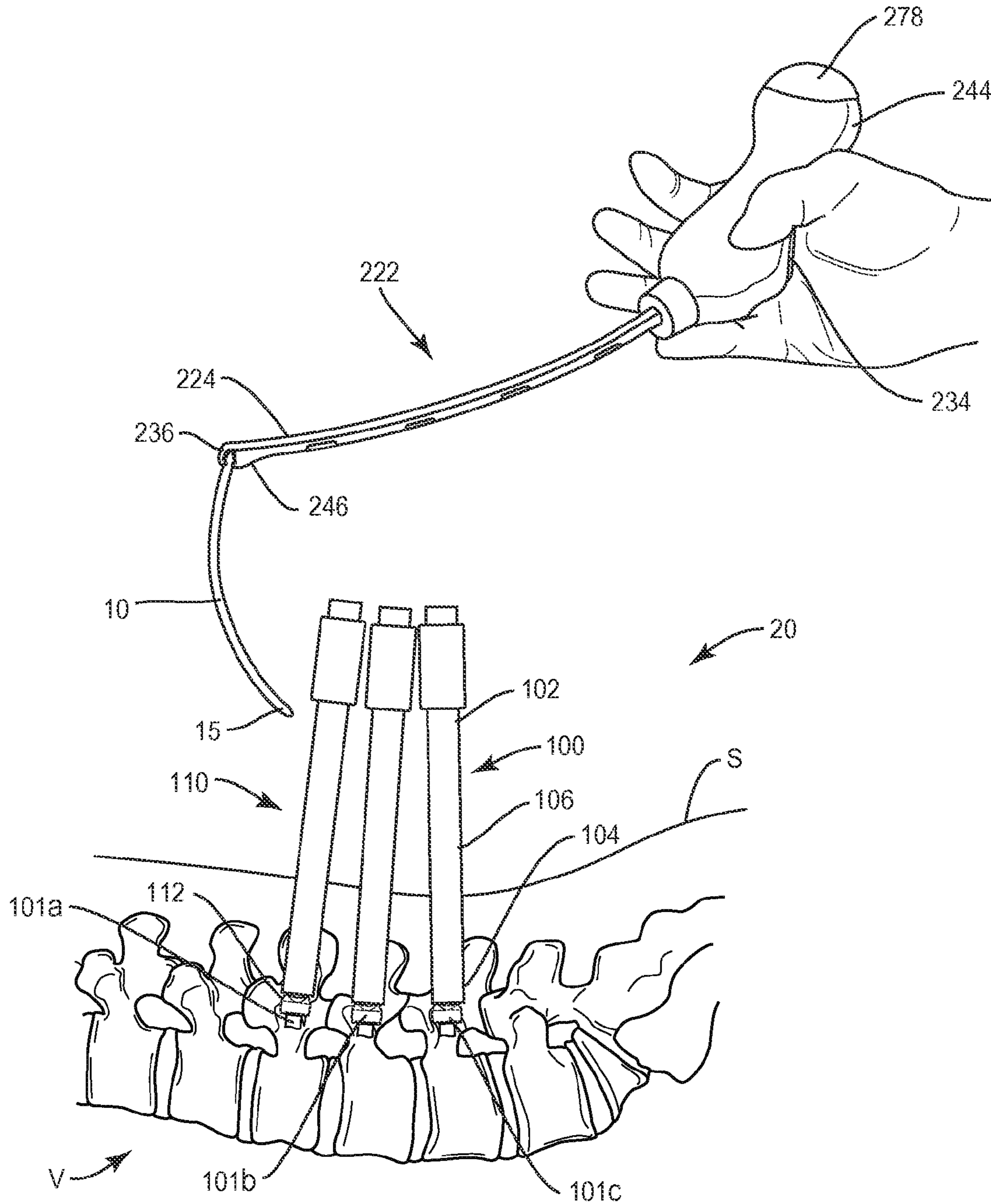


FIG. 11

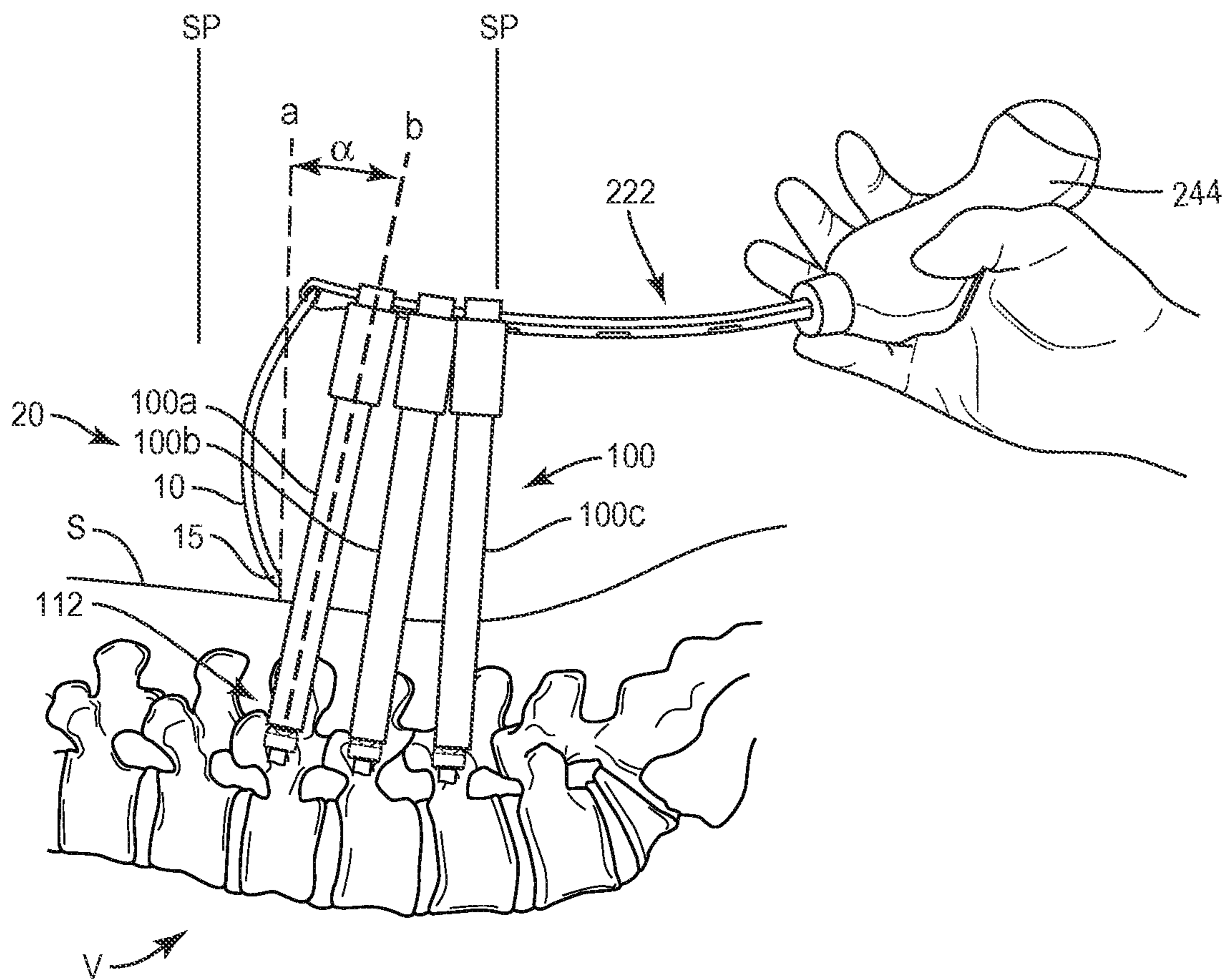


FIG. 12

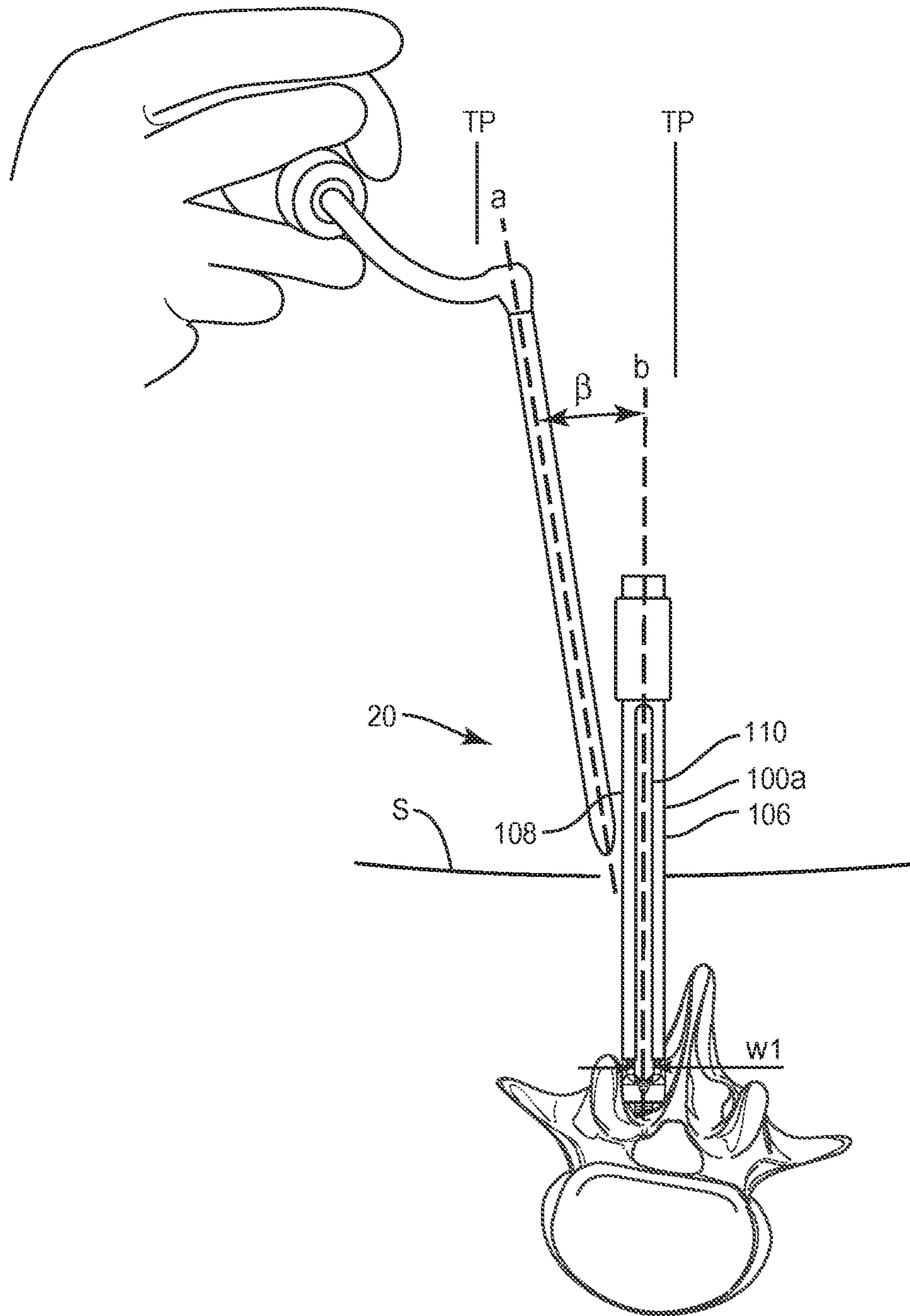


FIG. 13

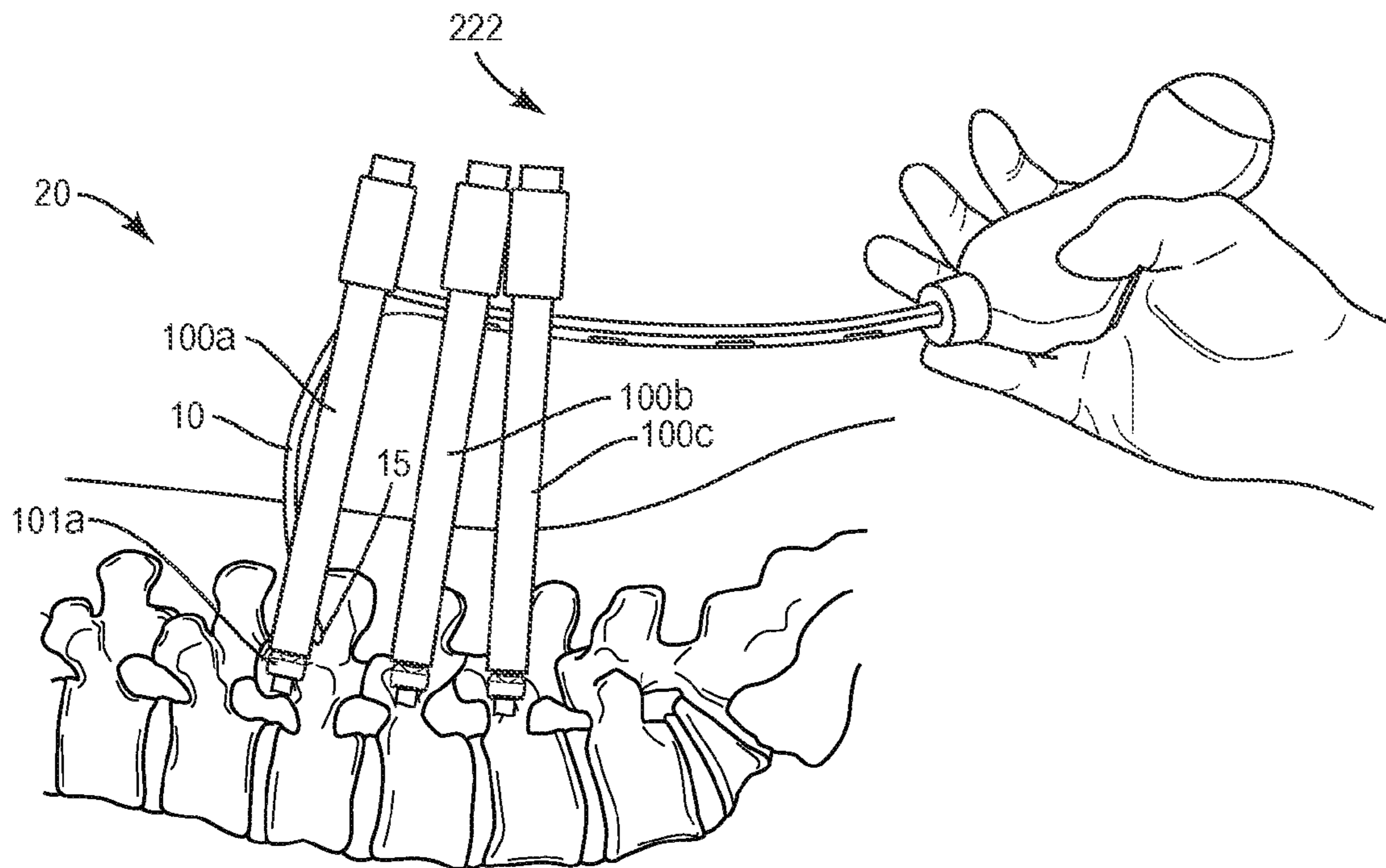


FIG. 14

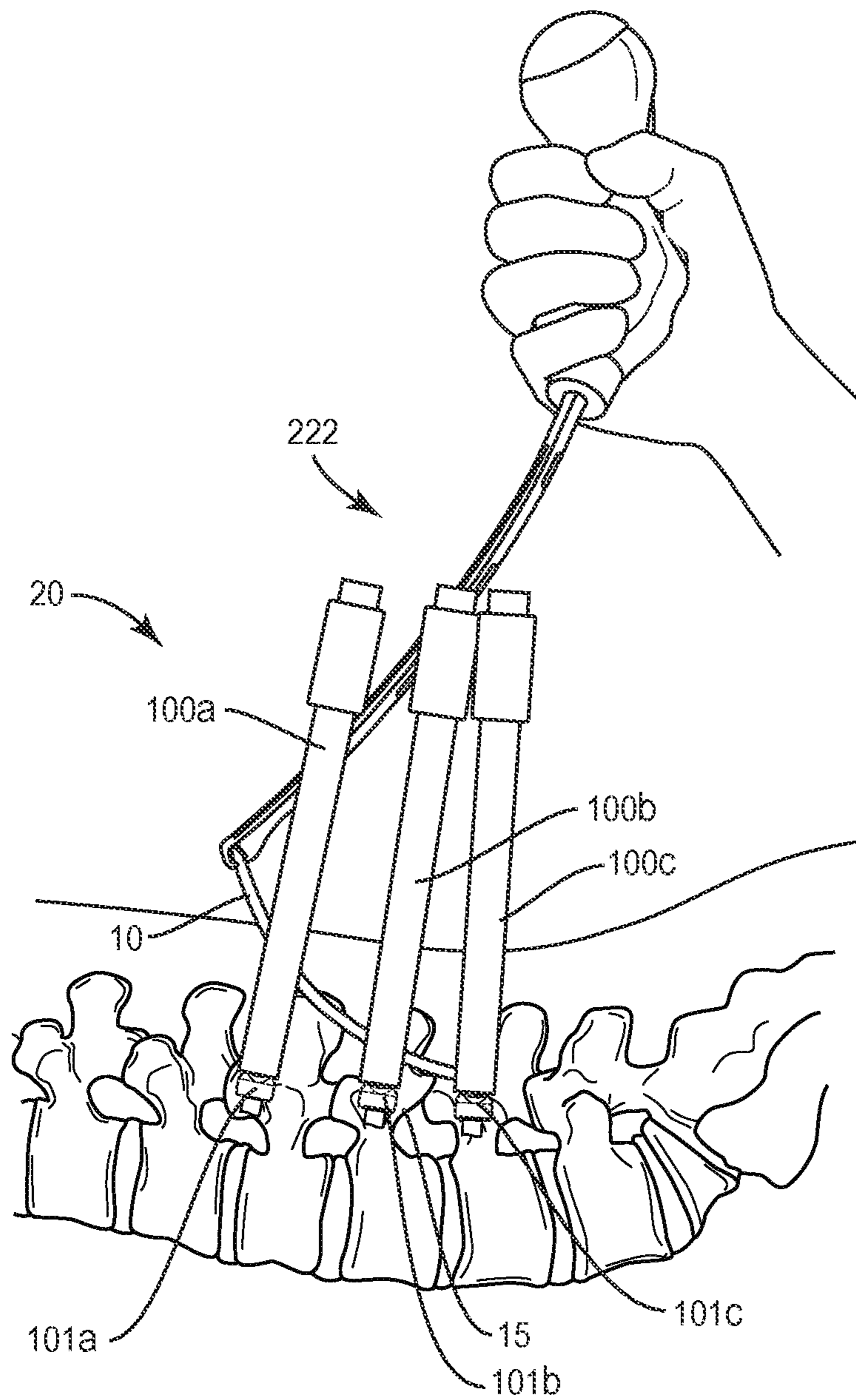


FIG. 15

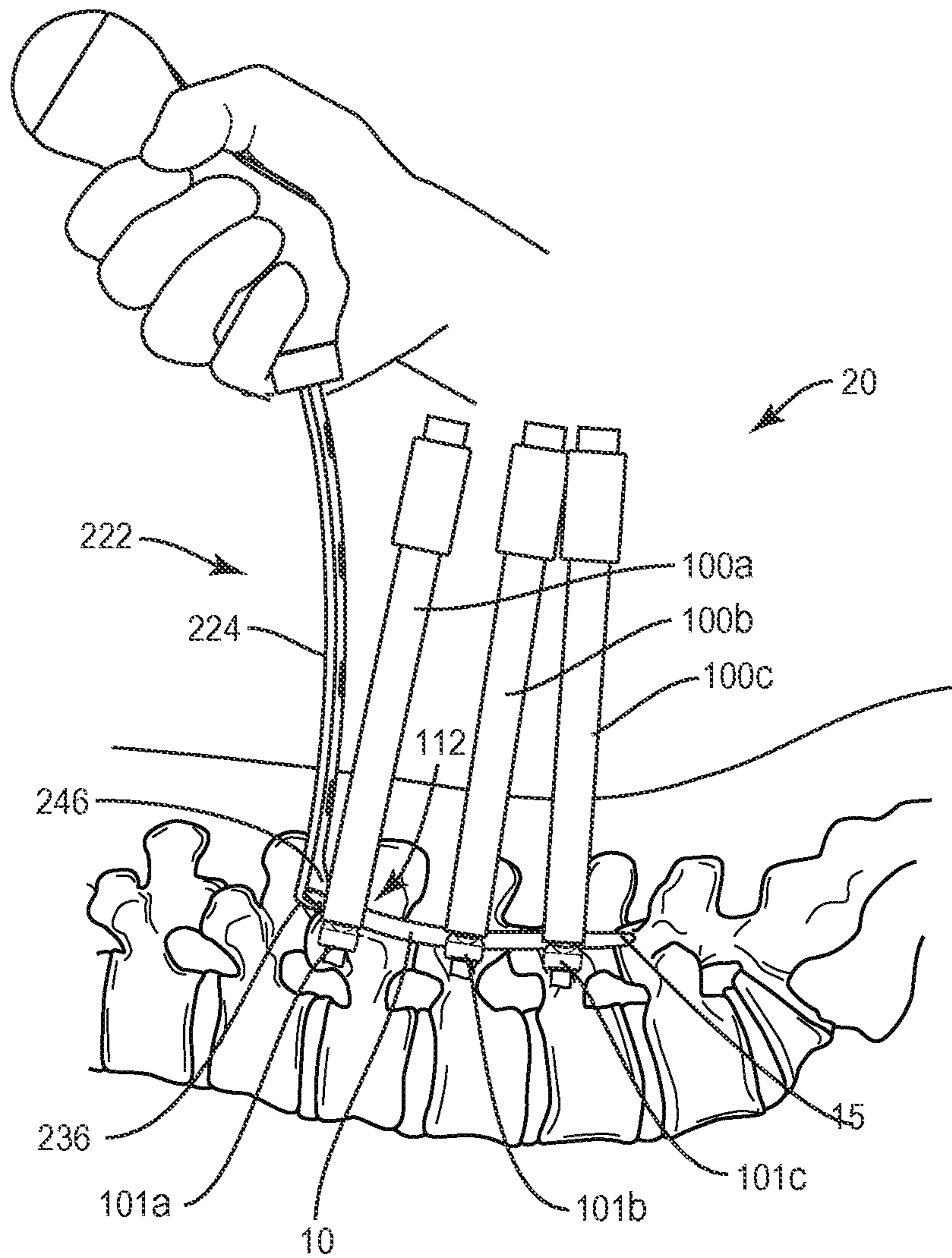


FIG. 16

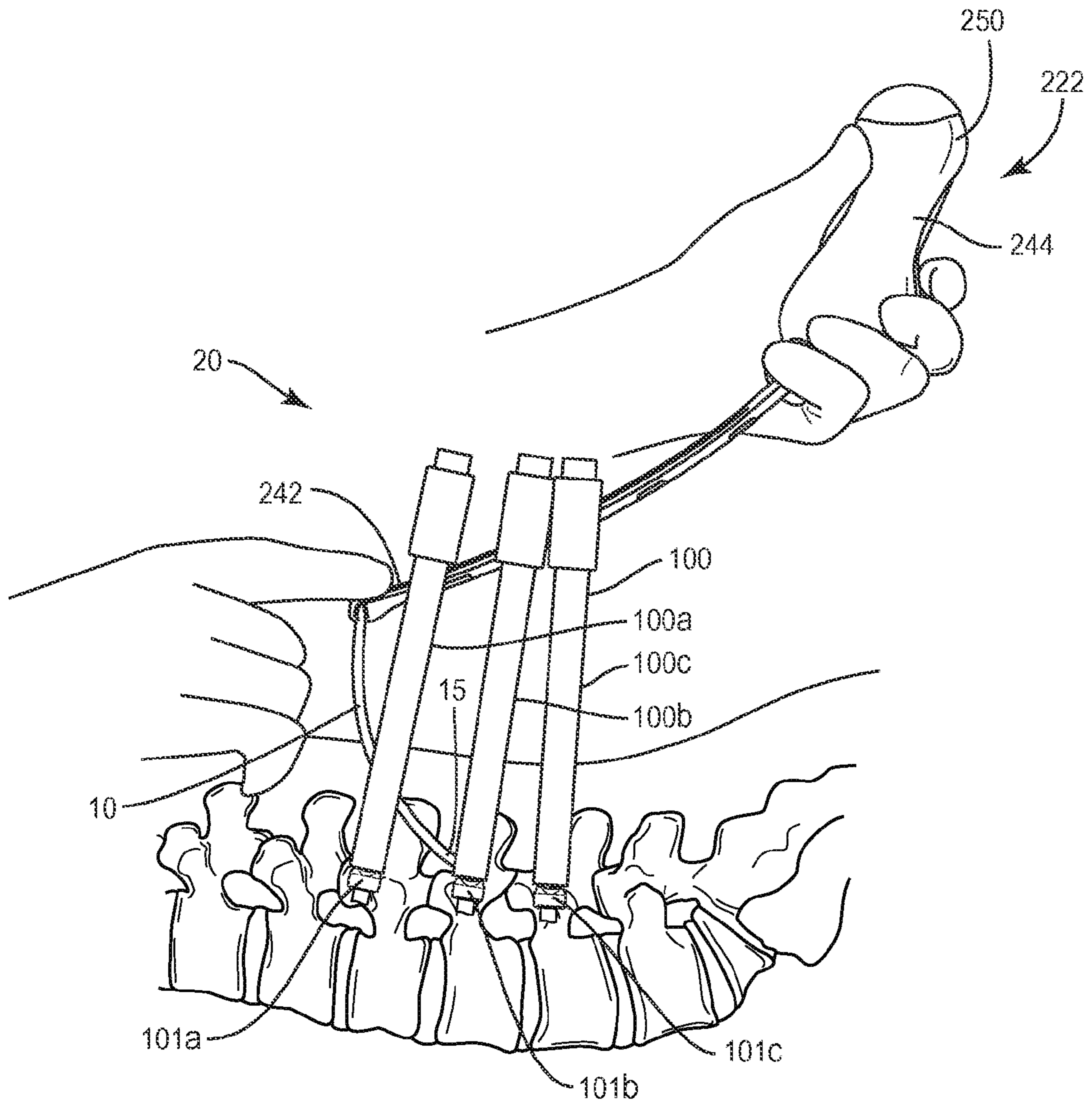


FIG. 17

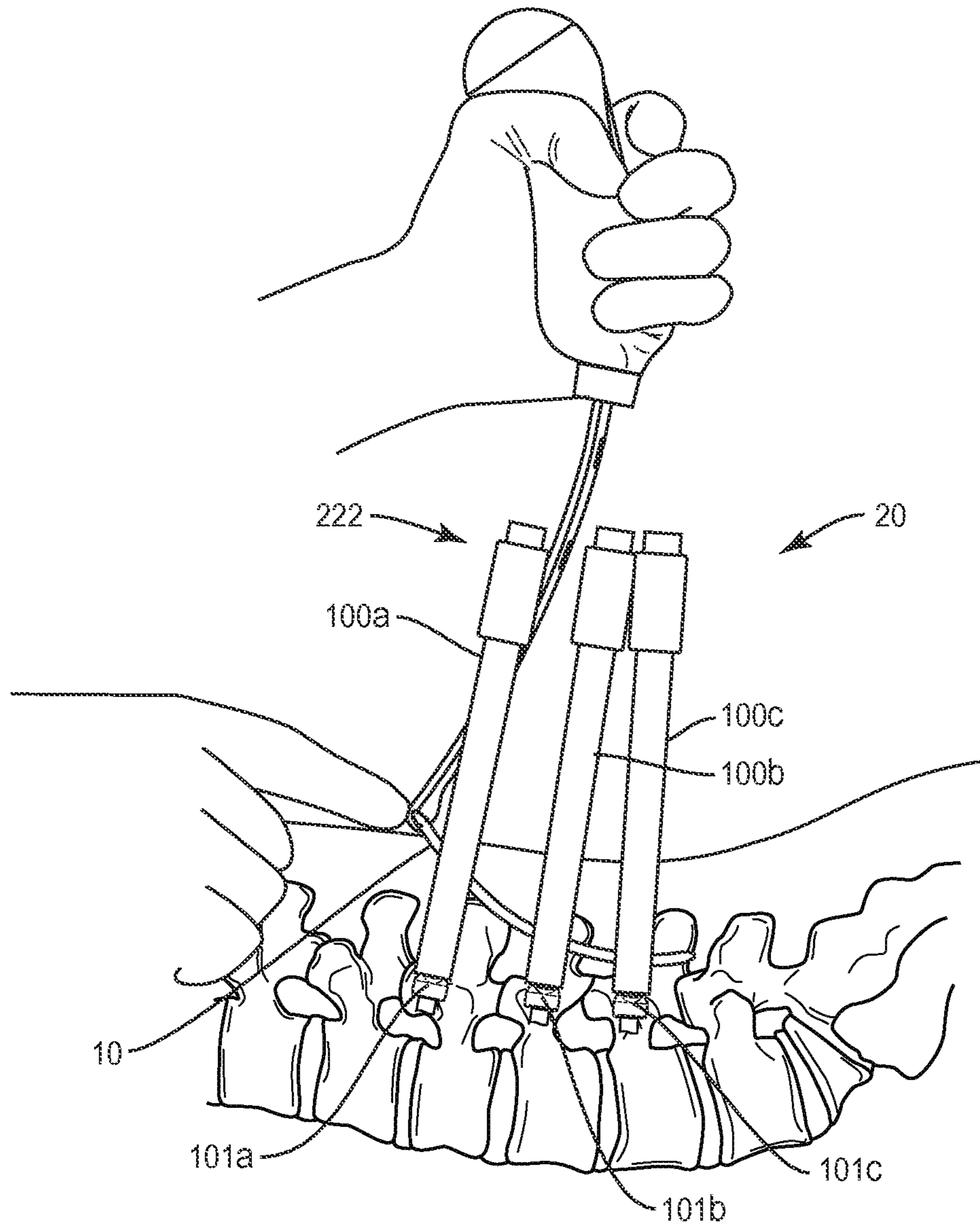


FIG. 18

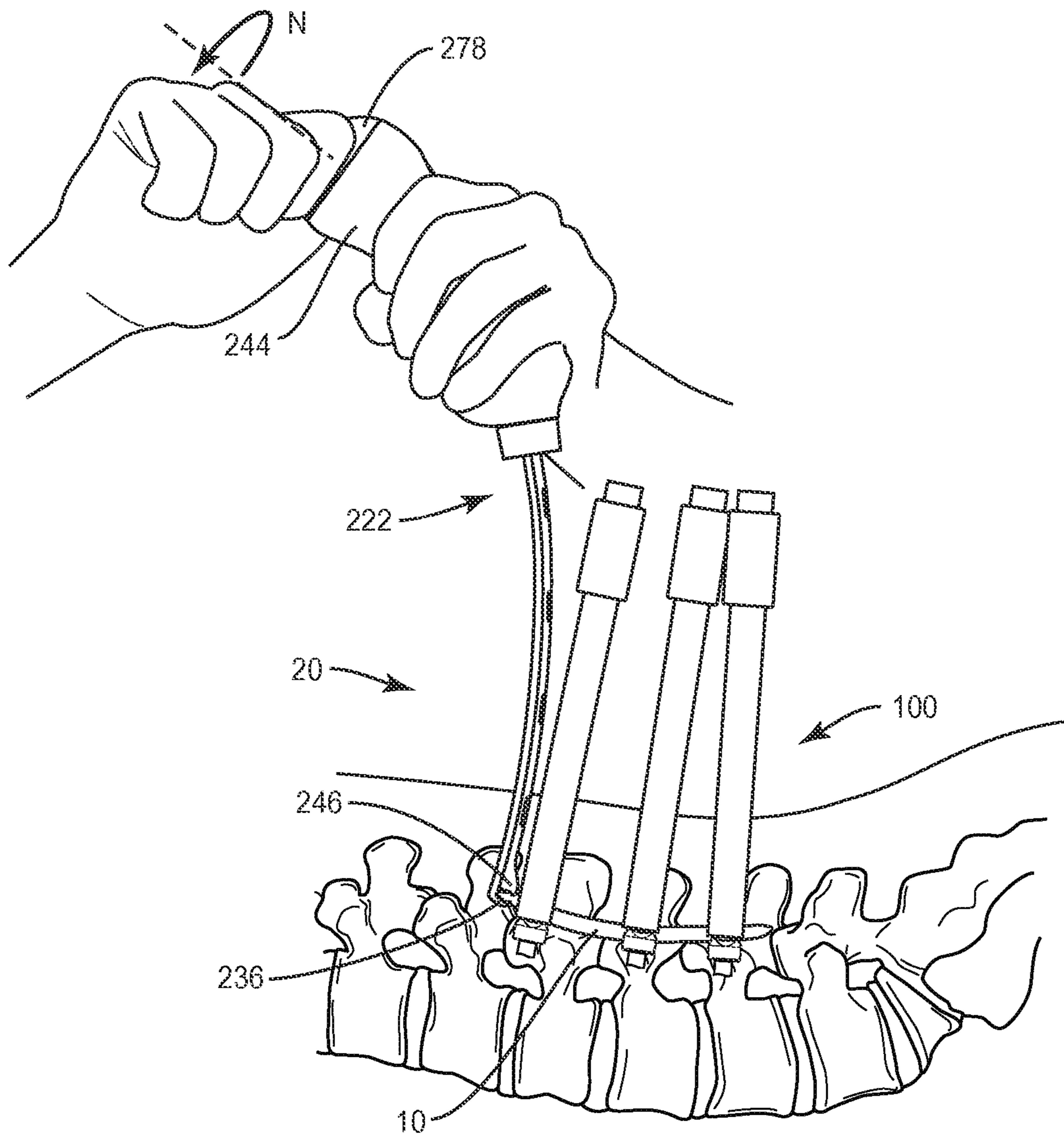


FIG. 19

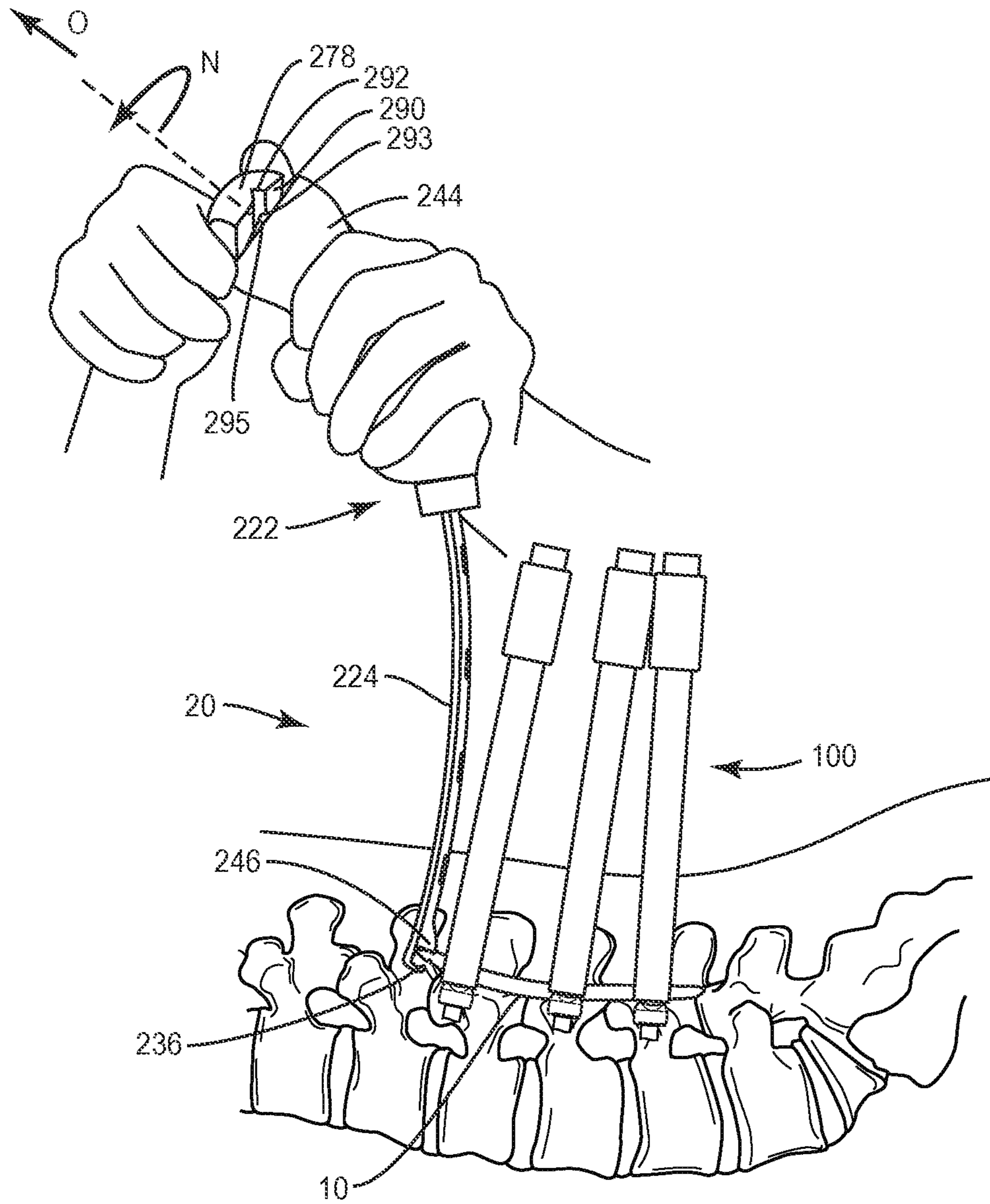


FIG. 20

1**SURGICAL IMPLANT SYSTEM AND METHOD**

TECHNICAL FIELD

The present disclosure generally relates to medical devices for the treatment of musculoskeletal disorders, and more particularly to a surgical implant system for implant delivery to a surgical site and a method for treating a spine.

BACKGROUND

Spinal pathologies and disorders such as scoliosis and other curvature abnormalities, kyphosis, degenerative disc disease, disc herniation, osteoporosis, spondylolisthesis, stenosis, tumor, and fracture may result from factors including trauma, disease and degenerative conditions caused by injury and aging. Spinal disorders typically result in symptoms including deformity, pain, nerve damage, and partial or complete loss of mobility.

Non-surgical treatments, such as medication, rehabilitation and exercise can be effective, however, may fail to relieve the symptoms associated with these disorders. Surgical treatment of these spinal disorders includes correction, fusion, fixation, discectomy, laminectomy and implantable prosthetics. As part of these surgical treatments, spinal constructs such as vertebral rods are often used to provide stability to a treated region. Rods redirect stresses away from a damaged or defective region while healing takes place to restore proper alignment and generally support the vertebral members. During surgical treatment, one or more rods and bone fasteners can be delivered to a surgical site. This disclosure describes an improvement over these prior art technologies.

SUMMARY

In one embodiment, a surgical instrument is provided. The surgical instrument comprises a body. A first member extends between a first end and a second end. A second member extends between a first end connected with the body and a second end. A third member is connected to the first end of the first member and the body to relatively axially translate the second ends. The third member includes a latch and a lock engageable with the latch. The latch is disposable in a locking orientation such that the second ends engage a spinal construct and rotatable to a non-locking orientation such that the lock disengages the latch and the latch is biased relative to the body such that the second ends are disposed to disengage the spinal construct.

BRIEF DESCRIPTION OF THE DRAWINGS

The present disclosure will become more readily apparent from the specific description accompanied by the following drawings, in which:

FIG. 1 is a side view of components of one embodiment of a surgical implant system in accordance with the principles of the present disclosure;

FIG. 2 is a perspective view of the components shown in FIG. 1;

FIG. 3 is a side view of the components shown in FIG. 1 with parts separated;

FIG. 4 is a break away view of the components shown in FIG. 2;

FIG. 5 is a break away view of the components shown in FIG. 2;

2

FIG. 6 is a side view of components of one embodiment of a surgical implant system in accordance with the principles of the present disclosure;

FIG. 7 is an enlarged break away view of the components shown in FIG. 6;

FIG. 8 is a side view of the components shown in FIG. 6;

FIG. 9 is a side view of components of one embodiment of a surgical implant system in accordance with the principles of the present disclosure;

FIG. 10 is a side view of the components shown in FIG. 9;

FIG. 11 is a side view of components of one embodiment of a surgical implant system in accordance with the principles of the present disclosure disposed with a body;

FIG. 12 is a side view of the components shown in FIG. 11 disposed with the body;

FIG. 13 is an end view of the components shown in FIG. 11 disposed with the body;

FIG. 14 is a side view of the components shown in FIG. 11 disposed with the body;

FIG. 15 is a side view of the components shown in FIG. 11 disposed with the body;

FIG. 16 is a side view of the components shown in FIG. 11 disposed with the body;

FIG. 17 is a side view of the components shown in FIG. 11 disposed with the body;

FIG. 18 is a side view of the components shown in FIG. 11 disposed with the body;

FIG. 19 is a side view of the components shown in FIG. 11 disposed with the body; and

FIG. 20 is a side view of the components shown in FIG. 11 disposed with the body.

DETAILED DESCRIPTION

The exemplary embodiments of the surgical implant system and related methods of use disclosed are discussed in terms of medical devices for the treatment of musculoskeletal disorders and more particularly, in terms of a surgical implant system for implant delivery to a surgical site and a method for treating a spine.

In one embodiment, the surgical implant system is employed with a method that includes inserting a rod through the same stab incision in which a pedicle screw was placed percutaneously. In one embodiment, the system includes a surgical instrument, such as, for example, a rod inserter. In one embodiment, the surgical instrument clamps an implant, such as, for example, a longitudinal rod, by pulling a flexible shaft through a cannulated main body of the rod inserter. In one embodiment, the surgical instrument includes an outer sleeve having a T-slot cross section and a flexible inner shaft having one or a plurality of T-shaped beads, for example, four beads, that movably retain the inner shaft with the outer sleeve. For example, the beads are assembled with the outer sleeve by passing the beads through openings of the outer sleeve. The beads are retained with the outer sleeve when a latch, described herein, is closed because a collet, described herein, is drawn through the T-slot and the beads are not visible in the openings.

In one embodiment, the system includes a surgical instrument, such as, for example, a rod inserter that can be used with extended tab screws or other extenders with an extended rod guide. In one embodiment, the rod is initially placed, inclined relative to the extenders, in a stab incision in which a pedicle screw has been placed percutaneously. The rod is moved to the surgical site such that the rod is inclined relative to the extenders. As the rod is moved closer

to a saddle of a pedicle screw, the rod is rotated to a position within a first and at least a second pedicle screw. Once in place, the rod is released. In one embodiment, the inserter shaft remains outside the screw extenders. In one embodiment, the shaft resides between two extensions attached to a pedicle screw or within a feature of an extender. In one embodiment, the geometry of the shaft allows the mechanism to have three functional components and a handle. In some embodiments, the method includes inserting a rod percutaneously without the need to make an additional incision.

In one embodiment, the surgical instrument, such as, for example, a rod inserter, includes a tension adjustment mechanism using a hex socket style adjustment. In one embodiment, the tension adjustment mechanism is externally controlled. In one embodiment, inserting a hex key into the socket turns a shaft threaded with the rod inserter to increase or decrease tension of the clamp. In one embodiment, the shaft is attached to a translation sleeve and is allowed to rotate in relation to the translation sleeve, which translates axially. In one embodiment, the rod inserter includes a leaf spring detent so that a user turns the shaft to set clamp force without any additional step being required. In one embodiment, the detent holds the shaft in place reducing the steps required to adjust the tension.

In one embodiment, the surgical instrument includes a rod inserter having an outer sleeve configured to fit between tab extenders and a clamp at its distal end configured not to fit between tab extenders. This configuration resists and/or prevents having a cone end of a spinal rod inside the tulip head of a bone screw. In one embodiment, the cone of the spinal rod is maintained outside of the tulip head so that the set screw clamps on the outer diameter of the rod to provide maximum grip strength. In one embodiment, the sides of the rod inserter clamps resist and/or prevent the clamp from entering too far into the extender or screw tulip.

In one embodiment, the surgical instrument includes a rod inserter having an ergonomic handle including a latch and a collet release for attachment of a rod to the inserter. In one embodiment, the rod inserter includes a collet at a distal end of the rod inserter. In some embodiments, the rod inserter allows the rod to be inserted through the same stab incision that the pedicle screw and extender were inserted. In one embodiment, the latch and release provide, for example, looser tolerances. In one embodiment, as the collet release is pulled a distance away from the handle, the latch rotates to protrude out of the handle. In one embodiment, applying a force to the latch to cause the latch to protrude further from the handle causes the collet at the distal end of the rod inserter to open and disengage the rod. In one embodiment, to close the collet, a force is applied to the latch in a direction towards the handle. In one embodiment, the rod inserter allows for disassembly and the handle is configured to be ergonomic irrespective of which direction a user is holding the handle. The rod inserter can be rotated, for example, 180 degrees and a user will still be able to grip the handle and manipulate it as required by a particular application.

In one embodiment, the surgical instrument includes a rod inserter having a latch, a collet release, a thumb groove, finger grooves and a collet. From a locking orientation, the collet is drawn such that the latch will pop out to a non-locking orientation. In some embodiments, from the non-locking orientation, the latch can be manually drawn open such that the collet is caused to open wider. A rod is inserted with the collet having the flats facing up. The latch is closed to lock the rod in place and the collet release returns to the locking orientation automatically. In one embodiment,

the surgical instrument allows a rod to be inserted through extenders along a path that includes a distal and/or far location from a practitioner and/or a selected starting point of the path, to a proximal and/or near location to the practitioner and/or selected endpoint of the path. In one embodiment, the surgical instrument allows a rod to be inserted through extenders along a path that includes a proximal and/or near location to the practitioner and/or selected starting point of the path, to a distal and/or far location from a practitioner and/or a selected endpoint of the path. The handle can be rotated 180 degrees.

In one embodiment, the collet release is disengageable such that the collet automatically translates, for example, is spring biased to a locked position. In one embodiment, the collet release is rotatable and/or can be pulled for automatic release. In one embodiment, the collet release and the handle have an inclined ramp configuration to facilitate locking and realigning the collet release in a locked position. In one embodiment, the collet release includes a V-shaped groove that mates with a V-shaped wedge of the handle. In one embodiment, the handle is ergonomically designed to be held in a plurality of orientations, for example, to release and tighten a collet supporting a spinal rod in the plurality of orientations. In one embodiment, the handle and an outer sleeve have the same radius. In one embodiment, the handle and the outer sleeve have a continuous curvature. In one embodiment, the handle and an outer sleeve have an offset radius. In one embodiment, the handle has a first radius and the outer sleeve has a second radius, the first radius and the second radius being distinct. In one embodiment, the handle has a first width and the outer sleeve has a second width, the first width and the second width being distinct.

In one embodiment, the rod inserter includes an internal pin that slides while the latch rotates to maintain the collet motion linear. In one embodiment, the rod inserter includes an outer sleeve having threads to aide in tightening of the collet. In one embodiment, the rod inserter includes a collet disposable in a first position to unlock the collet and release a rod. In one embodiment, in the second position, the collet translates, for example, is spring biased out for disassembly.

In one embodiment, the surgical instrument is employed with a surgical method that includes the steps of creating a first incision for disposal of at least one extender and creating an additional incision. In one embodiment, the method includes the step of inserting a spinal rod at a three dimensional angle in space, for example, angular orientations in intersecting planes, from a first extender until the spinal rod reaches a saddle of a screw. In one embodiment, the method includes the step of inserting a spinal rod at an angle, for example, a cephalad-caudal angle and an angle, for example, a medial/lateral angle relative to an extender. In one embodiment, the method includes the step of rotating the handle to push a tip of the spinal rod through the saddle and through to a second screw. In one embodiment, the step of rotating includes inserting and rotating the spinal rod within a coronal plane.

In one embodiment, the surgical instrument is employed with a surgical method that includes the steps of gripping an ergonomic handle of a percutaneous inserter in a selected orientation, and inserting a spinal rod at a three dimensional angle from an extender. In some embodiments, the method includes the step of simultaneously lowering and rotating a spinal rod through to subsequent extenders. In some embodiments, the method includes the step of releasing the spinal rod after insertion with a screw via a release knob and removing the inserter from a patient.

In one embodiment, the surgical instrument is employed with a surgical method for pulling a spinal rod, for example, along a far to near orientation, as described, through at least one extender, which includes the steps of gripping the handle of an inserter prior to insertion of the inserter with a body, the inserter having a spinal rod disposed therewith; inserting a distal tip of the spinal rod inside an extender window and an axis of the spinal rod being disposed at an angle offset from the extender until the spinal rod is below the skin and the fascia; disposing the spinal rod in a medial or lateral orientation to prevent the handle of the inserter from interfering with the extender to create a three dimensional angle; and simultaneously lowering the spinal rod to a first screw head while rotating the spinal rod through to subsequent extenders.

In one embodiment, the surgical instrument is employed with a surgical method for pushing a spinal rod, for example, along a near to far orientation, as described, through at least one extender, which includes the steps of gripping the handle of an inserter prior to insertion of the inserter with a body, the inserter having a spinal rod disposed therewith; and inserting a distal tip of the spinal rod inside an extender window and an axis of the spinal rod being disposed at an angle offset from the extender until the spinal rod is below the skin and the fascia; and simultaneously lowering the spinal rod to a first screw head while rotating the spinal rod through to subsequent extenders. In one embodiment, the method includes the step of removing the spinal rod from the inserter, which includes gripping a release knob of the inserter and rotating the release knob in a clockwise or counterclockwise direction, and/or pulling the release knob. In one embodiment, the method includes the step of removing the spinal rod from the inserter, which includes manipulating a release knob of the inserter and rotating the release knob to release the spinal rod from the inserter.

In one embodiment, one or all of the components of the system are disposable, peel-pack, pre-packed sterile devices used with an implant. One or all of the components of the system may be reusable. The system may be configured as a kit with multiple sized and configured components.

In some embodiments, the present disclosure may be employed to treat spinal disorders such as, for example, degenerative disc disease, disc herniation, osteoporosis, spondylolisthesis, stenosis, scoliosis and other curvature abnormalities, kyphosis, tumor and fractures. In some embodiments, the present disclosure may be employed with other osteal and bone related applications, including those associated with diagnostics and therapeutics. In some embodiments, the disclosed system and methods may be alternatively employed in a surgical treatment with a patient in a prone or supine position, and/or employ various surgical approaches to the spine, including anterior, posterior, posterior mid-line, lateral, postero-lateral, and/or antero-lateral approaches, and in other body regions. The present disclosure may also be alternatively employed with procedures for treating the lumbar, cervical, thoracic, sacral and pelvic regions of a spinal column. The system and methods of the present disclosure may also be used on animals, bone models and other non-living substrates, such as, for example, in training, testing and demonstration.

The present disclosure may be understood more readily by reference to the following detailed description of the embodiments taken in connection with the accompanying drawing figures, which form a part of this disclosure. It is to be understood that this application is not limited to the specific devices, methods, conditions or parameters described and/or shown herein, and that the terminology

used herein is for the purpose of describing particular embodiments by way of example only and is not intended to be limiting. Also, as used in the specification and including the appended claims, the singular forms “a,” “an,” and “the” include the plural, and reference to a particular numerical value includes at least that particular value, unless the context clearly dictates otherwise. Ranges may be expressed herein as from “about” or “approximately” one particular value and/or to “about” or “approximately” another particular value. When such a range is expressed, another embodiment includes from the one particular value and/or to the other particular value. Similarly, when values are expressed as approximations, by use of the antecedent “about,” it will be understood that the particular value forms another embodiment. It is also understood that all spatial references, such as, for example, horizontal, vertical, top, upper, lower, bottom, left and right, are for illustrative purposes only and can be varied within the scope of the disclosure. For example, the references “upper” and “lower” are relative and used only in the context to the other, and are not necessarily “superior” and “inferior”.

Further, as used in the specification and including the appended claims, “treating” or “treatment” of a disease or condition refers to performing a procedure that may include administering one or more drugs to a patient (human, normal or otherwise or other mammal), employing implantable devices, and/or employing instruments that treat the disease, such as, for example, microdiscectomy instruments used to remove portions bulging or herniated discs and/or bone spurs, in an effort to alleviate signs or symptoms of the disease or condition. Alleviation can occur prior to signs or symptoms of the disease or condition appearing, as well as after their appearance. Thus, treating or treatment includes preventing or prevention of disease or undesirable condition (e.g., preventing the disease from occurring in a patient, who may be predisposed to the disease but has not yet been diagnosed as having it). In addition, treating or treatment does not require complete alleviation of signs or symptoms, does not require a cure, and specifically includes procedures that have only a marginal effect on the patient. Treatment can include inhibiting the disease, e.g., arresting its development, or relieving the disease, e.g., causing regression of the disease. For example, treatment can include reducing acute or chronic inflammation; alleviating pain and mitigating and inducing re-growth of new ligament, bone and other tissues; as an adjunct in surgery; and/or any repair procedure. Also, as used in the specification and including the appended claims, the term “tissue” includes soft tissue, ligaments, tendons, cartilage and/or bone unless specifically referred to otherwise.

The following discussion includes a description of a surgical implant system and related methods of employing the surgical implant system in accordance with the principles of the present disclosure. Alternate embodiments are also disclosed. Reference will now be made in detail to the exemplary embodiments of the present disclosure, which are illustrated in the accompanying figures. Turning to FIGS. 1-8, there are illustrated components of a surgical system, such as, for example, a surgical implant system **20** in accordance with the principles of the present disclosure.

The components of system **20** can be fabricated from biologically acceptable materials suitable for medical applications, including metals, synthetic polymers, ceramics and bone material and/or their composites, depending on the particular application and/or preference of a medical practitioner. For example, the components of system **20**, individually or collectively, can be fabricated from materials

such as stainless steel alloys, commercially pure titanium, titanium alloys, Grade 5 titanium, super-elastic titanium alloys, cobalt-chrome alloys, stainless steel alloys, super-elastic metallic alloys (e.g., Nitinol, super elasto-plastic metals, such as GUM METAL® manufactured by Toyota Material Incorporated of Japan), ceramics and composites thereof such as calcium phosphate (e.g., SKELITE™ manufactured by Biologix Inc.), thermoplastics such as polyaryletherketone (PAEK) including polyetheretherketone (PEEK), polyetherketoneketone (PEKK) and polyetherketone (PEK), carbon-PEEK composites, PEEK-BaSO₄ polymeric rubbers, polyethylene terephthalate (PET), fabric, silicone, polyurethane, silicone-polyurethane copolymers, polymeric rubbers, polyolefin rubbers, hydrogels, semi-rigid and rigid materials, elastomers, rubbers, thermoplastic elastomers, thermoset elastomers, elastomeric composites, rigid polymers including polyphenylene, polyamide, polyimide, polyetherimide, polyethylene, epoxy, bone material including autograft, allograft, xenograft or transgenic cortical and/or corticocancellous bone, and tissue growth or differentiation factors, partially resorbable materials, such as, for example, composites of metals and calcium-based ceramics, composites of PEEK and calcium based ceramics, composites of PEEK with resorbable polymers, totally resorbable materials, such as, for example, calcium based ceramics such as calcium phosphate, tri-calcium phosphate (TCP), hydroxyapatite (HA)-TCP, calcium sulfate, or other resorbable polymers such as polyacetide, polyglycolide, polytyrosine carbonate, polycaprolactone and their combinations. Various components of system 20 may have material composites, including the above materials, to achieve various desired characteristics such as strength, rigidity, elasticity, compliance, biomechanical performance, durability and radiolucency or imaging preference. The components of system 20, individually or collectively, may also be fabricated from a heterogeneous material such as a combination of two or more of the above-described materials. The components of system 20 may be monolithically formed, integrally connected or include fastening elements and/or instruments, as described herein.

System 20 is employed, for example, with a minimally invasive procedure, including percutaneous techniques, mini-open and open surgical techniques to deliver and introduce an implant, such as, for example, a spinal construct, at a surgical site within a body of a patient, for example, a section of a spine. In some embodiments, system 20 may include and/or deliver and introduce implants such as spinal rods, bone fasteners, connectors, plates and interbody devices. System 20 includes a surgical instrument 22 that is configured for engagement with a spinal construct, such as, for example, a spinal rod 10.

Instrument 22 includes a first member, such as, for example, a flexible inner shaft 24 extending between an end 26 and an end 28. Shaft 24 has a cylindrical cross-section configuration. In some embodiments, shaft 24 may have variously configured cross-sections, such as, for example, round, oval, rectangular, polygonal, irregular and/or tapered. End 26 includes a bead 30 configured for translation within a slot 32 of a latch 34. End 28 includes a clamp, such as, for example, a jaw 36 that is configured for engagement with spinal rod 10. Shaft 24 includes a range of translation between a proximal most position and a distal most position. In some embodiments, shaft 24 can include a socket configured to engage a correspondingly shaped portion of a driving tool (not shown) such that shaft 24 translates relative

to sleeve 38 to selectively tension the engagement of jaws 36, 46 with spinal rod 10 to selectively set the clamping force on spinal rod 10.

Instrument 22 includes a second member, such as, for example, an outer sleeve 38. Sleeve 38 extends between an end 40 and an end 42. End 40 includes a threaded outer surface 41 configured for threaded engagement with a rotatable part, such as, for example, a hex nut 51 of a handle body 44 such that sleeve 38 translates relative to handle body 44 to selectively tension the engagement of jaws 36, 46 with spinal rod 10 to selectively set the clamping force on spinal rod 10. End 42 includes a clamp, such as, for example, a jaw 46. Jaws 36, 46 comprise a collet of instrument 22. Relative movement of jaws 36, 46 is facilitated with relative axial translation of shaft 24 and sleeve 38.

Sleeve 38 defines a cavity configured for disposal of a portion of shaft 24. Sleeve 38 has an arcuate curvature, which defines a radius of curvature, extending between ends 40, 42. In one embodiment, the cavity of sleeve 38 has a T-slot cross section for disposal of shaft 24. Shaft 24 includes four T-shaped beads spaced apart along shaft 24 that movably retain shaft 24 with sleeve 38. For example, the beads are assembled with sleeve 38 by passing the beads through openings 48 of sleeve 38. In one embodiment, the beads are retained with sleeve 38 when a latch, described herein, is closed because a collet, described herein, is drawn through the T-slot cavity of sleeve 38 and the beads are not visible in openings 48. In one embodiment, openings 48 provide visualization of shaft 24 and cleaning. In some embodiments, sleeve 38 may have alternate cross section shapes, such as, for example, oval, circular, oblong, triangular, square, polygonal, irregular, uniform, non-uniform, offset, staggered, undulating, arcuate, variable and/or tapered depending on a particular application.

Handle body 44 extends between an end 50 and an end 52. End 50 includes hex nut 51 configured for threaded engagement with end 40. Hex nut 51 is rotatably connected to end 50. Rotation of hex nut 51 causes axial translation of sleeve 38 relative to handle body 44 to selectively tension the engagement of jaws 36, 46 with spinal rod 10 to selectively set the clamping force on spinal rod 10. Handle body 44 has an arcuate curvature, which defines a radius of curvature, extending between ends 50, 52. End 50 defines a cavity 54 configured for disposal of a portion of shaft 24. Handle body 44 includes an outer surface 56 that defines finger grooves 58 and a thumb groove 60. In some embodiments, outer surface 56 may have various surface configurations, such as, for example, rough, threaded, arcuate, undulating, porous, semi-porous, dimpled, polished and/or textured, to enhance gripping of handle body 44.

In one embodiment, handle body 44 is ergonomically designed to be held in a plurality of orientations such that jaws 36, 46 support spinal rod 10 in a plurality of orientations. In some embodiments, the plurality of orientations can include relative angular orientations, parallel, perpendicular, offset and/or include manipulation of the planes of a body, such as, for example, coronal, sagittal and/or transverse. In one embodiment, handle body 44 and sleeve 38 have the same radius. In one embodiment, handle body 44 and sleeve 38 have a continuous curvature. In one embodiment, handle body 44 and sleeve 38 have an offset radius. In one embodiment, handle body 44 has a first radius and sleeve 38 has a second radius, the first radius and the second radius being distinct. In one embodiment, handle body 44 has a first width and sleeve 38 has a second width, the first width and the second width being distinct. In some embodiments, handle body 44 includes an outer surface having a plurality of

widths, the widths having an ergonomic configuration to facilitate manipulation thereof.

Handle body **44** defines a cavity configured for disposal of a third member, such as, for example, an actuator, which includes a part, such as, for example, manipulable latch **34** mounted with handle body **44**. Latch **34** is resiliently biased for rotation relative to handle body **44** by a biasing member, such as, for example, a torsion spring **64**. In some embodiments, the biasing member may include an elastomeric member, clip, leaf spring, coil spring, gravity induced configuration, pneumatic configuration, hydraulic configuration and/or manual lever.

Spring **64** is disposed within handle body **44** and rotates latch **34** between a non-locking orientation, as shown in FIG. **1**, and a locking orientation, as shown in FIG. **2**. Latch **34** is manipulable to the non-locking orientation, as shown in FIG. **6**, to release spinal rod **14** from jaws **36**, **46**. Latch **34** defines a cavity **66** configured for disposal of a locking element, such as, for example, a collet release **68**, as described herein. Latch **34** is connected to handle body **44** via a pin **62** at a pivot point **70**. In some embodiments, from the non-locking orientation, latch **34** can be manually drawn open such that jaws **36**, **46** are caused to open wider.

Latch **34** and shaft **24** are connected such that rotation of latch **34** about pivot point **70** causes axial translation of shaft **24** within and relative to sleeve **38**. For example, latch **34** can include slot **32** configured for translation of bead **30** of shaft **24** between movable limits provided by the surface that defines slot **32**. Slot **32** extends between a first movable limit, such as, for example, an end **72** and a second movable limit, such as, for example, an end **74** having a uniform thickness therebetween. Bead **30** is translatable between ends **72** and **74**.

Collet release **68** is resiliently biased to engage latch **34** via a biasing member, such as, for example, a coil spring **76** disposed within handle body **44**. In some embodiments, the biasing member may include an elastomeric member, clip, torsion spring, leaf spring, gravity induced configuration, pneumatic configuration, hydraulic configuration and/or manual lever. Collet release **68** includes a first portion, such as, for example, a release handle **78** and a second portion, such as, for example, a lock **80** extending therefrom. Release handle **78** is connected to lock **80** via a pin **82** and spring **76** is disposed about lock **80**.

Release handle **78** is manipulable axially to a non-locking orientation to release latch **34** for rotation to the non-locking orientation, as shown in FIG. **5**, and such that spring **76** is compressed between release handle **78** and a flange **84** of lock **80**. In the non-locking orientation, spring **76** is configured to bias lock **80** into a locking orientation with latch **34**. Lock **80** includes an inclined ramp **86** configured for engagement with a ledge **88** of latch **34**. Lock **80** includes a surface **87** disposed adjacent inclined ramp **86** configured for engagement with a ledge **90** of latch **34** to retain latch **34** in a locking orientation. Surface **87** and ledge **90** are engageable between the locking and non-locking orientations of collet release **68** to dispose latch **34** between the locking and non-locking orientations of latch **34**, as described herein.

For example, collet release **68** is movable between a locking orientation, as shown in FIG. **2**, such that surface **87** is fixed with ledge **90** so that lock **80** prevents latch **34** from rotating relative to handle body **44** and a non-locking orientation, as shown in FIG. **5**, such that ledge **90** is released from surface **87** and latch **34** is rotatable via spring **64**. In some embodiments, latch **34** can be angled between 10 and 80 degrees relative to shaft **24** and sleeve **38** such that

in the locking orientation, latch **34** is substantially non-parallel and non-perpendicular with an extender, as described herein.

In operation, instrument **22** is selectively movable between a non-locking orientation, as shown in FIGS. **6** and **7**, and a locking orientation, as shown in FIG. **8**. In the locking orientation, jaws **36**, **46** are disposed in a capturing engagement with spinal rod **10**. To release spinal rod **10** from jaws **36**, **46**, a force, in the direction shown by arrow **A** in FIG. **4**, is applied to release handle **78** to actuate collet release **68**. Surface **87** is released from ledge **90** such that latch **34** is rotatable relative to handle body **44** about pivot point **70**. Latch **34** rotates, in the direction shown by arrow **B** in FIG. **5**, via spring **64**, to dispose latch **34** in a non-locking orientation. Latch **34** rotates and bead **30** is disposed with end **74** of slot **32** and latch **34** protrudes from handle body **44**.

Rotation of latch **34** to the non-locking orientation causes shaft **24** to axially translate, in the direction shown by arrow **D** in FIGS. **6** and **7**, relative to handle body **44** and sleeve **38**. Bead **30** translates along slot **32** to end **72** to facilitate axial translation of shaft **24** during rotation of latch **34**. The axial translation of shaft **24** causes jaw **36** to separate from jaw **46** to release spinal rod **10** from capture.

From the non-locking orientation, latch **34** can be rotated such that instrument **22** is disposable in the locking orientation, for example, such that jaws **36**, **46** engage and capture spinal rod **10**. From the non-locking orientation, a force is applied to latch **34**, in the direction shown by arrow **E** in FIG. **6**, causing latch **34** to rotate in the direction shown by arrow **E** to close jaws **36**, **46** such that shaft **24** axially translates, in the direction shown by arrow **F** in FIGS. **6** and **7**, relative to handle body **44** and sleeve **38** to capture spinal rod **10** and dispose instrument **22** in the locking orientation, as shown in FIG. **8**. Rotation of latch **34** to its locking orientation facilitates translation of collet release **68** such that spring **76** biases collet release **68** to the locking orientation, as described, such that collet release **68** automatically returns to the locking orientation.

In one embodiment, as shown in FIGS. **9** and **10**, system **20**, similar to the systems described above with regard to FIGS. **1-8**, comprises an instrument **222**, similar to instrument **12**, described above, configured for engagement with spinal rod **10**.

Instrument **222** includes a first member, such as, for example, a flexible inner shaft **224** extending between an end **226** and an end **228**, similar to shaft **24** described above. End **226** includes a bead **230** configured for translation within a slot **232** of a latch **234**, similar to latch **34** described above. End **228** includes a clamp, such as, for example, a jaw **236**, similar to jaw **36** described above.

Instrument **222** includes a second member, such as, for example, an outer sleeve **238**, similar to sleeve **38** described above. Sleeve **238** extends between an end **240** and an end **242**. End **240** is configured for fixed engagement with an interior surface (not shown) of a handle body **244**, similar to handle body **44** described above. End **242** includes a clamp, such as, for example, a jaw **246**, similar to jaw **46** described above. Jaws **236**, **246** comprise a collet of instrument **222**. Relative movement of jaws **236**, **246** is facilitated with relative axial translation of shaft **224** and sleeve **238**.

Sleeve **238** defines a T-shaped cavity configured for disposal of correspondingly shaped beads of shaft **224**, similar to that described with regard to sleeve **38** and shaft **24** above. Sleeve **238** has an arcuate curvature, which defines a radius of curvature, extending between ends **240**,

242. Sleeve 238 includes a plurality of openings 248 to provide visualization of shaft 224, disposal of the beads and cleaning.

Handle body 244 extends between an end 250 and an end 252. End 250 is configured for fixed engagement with end 240 of sleeve 238. Handle body 244 has an arcuate curvature, which defines a radius of curvature, extending between ends 250, 252. End 250 defines a cavity 254 configured for disposal of a portion of shaft 224. In one embodiment, the radius of handle body 244 is substantially equivalent to the radius of sleeve 238. In one embodiment, the radius of handle body 244 is substantially offset from the radius of sleeve 238.

Handle body 244 includes an outer surface 256 that defines finger grooves 258 and a thumb groove 260. In one embodiment, outer surface 256 defines finger grooves 259 disposed opposite finger grooves 258 and a thumb groove 261 disposed opposite thumb groove 260.

Handle body 244 defines a cavity 271 configured for disposal of a third member, such as, for example, an actuator, which includes a part, such as, for example, latch 234 mounted with handle body 244. Latch 234 is resiliently biased for rotation relative to handle body 244 by a biasing member, such as, for example, a torsion spring 264.

Spring 264 is centrally disposed within handle body 244 between ends 250, 252 and rotates latch 234 between a locking orientation, as shown in FIG. 9, and a non-locking orientation, as shown in phantom in FIG. 10, to release spinal rod 10 from jaws 236, 246. In some embodiments, from the non-locking orientation, latch 234 can be manually drawn open such that jaws 236, 246 are caused to open wider and/or for disassembly of the components of instrument 222.

Latch 234 defines a cavity 266 configured for disposal of at least a portion of a locking element, such as, for example, a collet release 268, similar to collet release 68 described above. Latch 234 includes a pin 262 disposed through a thickness of latch 234 at a central location of latch 234. Latch 234 is connected to handle body 244 via pin 262 at a pivot point 270 centrally disposed between ends 250, 252 of handle body 244 for rotation of latch 234 relative to handle body 244.

Latch 234 and shaft 224 are connected such that rotation of latch 234 about pivot point 270 causes axial translation of shaft 224 within and relative to sleeve 238. For example, latch 234 can include slot 232 configured for translation of bead 230 of shaft 224 between movable limits provided by the surface that defines slot 232. Slot 232 extends between a first movable limit, such as, for example, an end 272 and a second movable limit, such as, for example, an end 274 having a uniform thickness therebetween. Bead 230 is translatable between ends 272 and 274.

Collet release 268 is resiliently biased to engage latch 234 via a biasing member, such as, for example, a coil spring (not shown) disposed within handle body 244. Collet release 268 includes a first portion, such as, for example, a release handle 278 and a second portion, such as, for example, a lock 280 extending therefrom. Release handle 278 has a semi-circular shape and is dimensioned such that release handle 278 and end 252 of handle body 244 are disposed in a flush engagement in a locking orientation of collet release 268. Release handle 278 is connected to lock 280 via a pin 282.

Release handle 278 is manipulable to a non-locking orientation to release latch 234 for rotation to the non-locking orientation of latch 234 such that the coil spring is compressed between a flange 284 of lock 280 and release handle 278. In the non-locking orientation of collet release

268, the coil spring is configured to bias lock 280 into a locking orientation with latch 234. Lock 280 includes an inclined ramp 286 configured for engagement with an inclined ramp 288 of latch 234. Ramp 288 engages ramp 286 as latch 234 is rotated to the locking orientation of latch 234, as shown in FIG. 10, to facilitate engagement of lock 280 with latch 234 and disposal of release handle 278 in the locking orientation of collet release 268. Lock 280 includes a surface 287 disposed adjacent inclined ramp 286 configured for engagement with an inner wall 289 of cavity 266 to retain latch 234 in a locking orientation.

A cam surface 290, as shown in FIG. 20, of release handle 278 defines a groove 292 having a V-shaped cross section. Groove 292 is configured for engagement and mating with a cam surface 293 of handle body 244 that defines a wedge 295 having a V-shaped cross section. For example, in the locking orientation of collet release 268, as shown in FIG. 10, wedge 295 is disposed in groove 292 and release handle 278 is disposed in flush engagement with handle body 244. As release handle 278 is rotated, the surface of groove 292 slides along wedge 295 separating release handle 278 from handle body 244 in an axial direction. Lock 280 is drawn in an axial direction such that surface 287 is released from inner wall 289. Latch 234 is rotatable from the locking orientation to the non-locking orientation, as shown in phantom in FIG. 10. In one embodiment, release handle 278 is rotated, in a plane transverse to the longitudinal axis of handle body 244, between the locking orientation and the non-locking orientation to release lock 280 from latch 234 and/or to engage lock 280 with latch 234. In one embodiment, release handle 278 is drawn axially between the locking orientation and the non-locking orientation to release lock 280 from latch 234 and/or to engage lock 280 with latch 234.

In operation, instrument 222 is selectively movable between a non-locking orientation, as shown in phantom in FIG. 10 and similar to that shown and described in FIG. 6, and a locking orientation, as shown in FIG. 10 and similar to that shown and described in FIG. 8. In the locking orientation, jaws 236, 246 are disposed in a capturing engagement with spinal rod 10. Bead 230 is disposed with end 272 of slot 232 and latch 234 is disposed in flush alignment with handle body 244.

To release spinal rod 10 from jaws 236, 246, release handle 278 is rotated, for example, in the direction shown by arrow G in FIG. 10, to actuate collet release 268. As release handle 278 is rotated, the surface of groove 292 slides along wedge 295 separating release handle 278 from handle body 244, in the axial direction shown by arrow H. Lock 280 is drawn in the axial direction such that surface 287 is released from inner wall 289 such that latch 234 is rotatable relative to handle body 244 about pivot point 270. Latch 234 rotates, in the direction shown by arrow I, for disposal in the non-locking orientation. Latch 234 rotates and protrudes from handle body 244.

Rotation of latch 234 to the non-locking orientation causes shaft 224 to axially translate, in the direction shown by arrow J, relative to handle body 244 and sleeve 238. Bead 230 translates along slot 232 for disposal with end 274 to facilitate axial translation of shaft 224 during rotation of latch 234, as shown in phantom. The axial translation of shaft 224 causes jaw 236 to separate from jaw 246 to release spinal rod 10 from capture.

From the non-locking orientation, latch 234 can be rotated such that instrument 222 is disposable in the locking orientation, for example, such that jaws 236, 246 engage and capture spinal rod 10. From the non-locking orientation,

release handle **278** is rotated, for example, in the direction shown by arrow **K**, such that the surface of groove **292** slides along wedge **295**. In some embodiments, release handle **278** can be rotated in either direction to lock and unlock latch **234**. In some embodiments, release handle **278** is rotated in a first direction to lock latch **234** and then rotated in an opposite direction to unlock latch **234**. Wedge **295** is aligned with groove **292** for disposal therein and release handle **278** is disposed in flush engagement with handle body **244**. Lock **280** is biased to the locking orientation of collet release **268**.

Latch **234** is rotated, in the direction shown by arrow **L**, such that ramp **288** engages and slides over ramp **286**, as facilitated by the resilient bias of lock **280**, to dispose latch **234** in the locking orientation. Surface **287** and inner wall **289** engage to prevent rotation of latch **234** from the locking orientation. Rotation of latch **234** to the locking orientation causes shaft **224** to axially translate, in the direction shown by arrow **M**, relative to handle body **244** and sleeve **238**, to close jaws **236**, **246** and capture spinal rod **10**.

System **20** includes a plurality of extenders **100**, as shown in FIGS. **11-20**, configured for connection with bone fasteners and to facilitate disposal of spinal rod **10** with bone fasteners. Each extender **100** extends between a proximal end **102** and a distal end **104**. Each extender **100** includes a first wall, such as, for example, a rail **106** and a second wall, such as, for example, a rail **108**. Rails **106**, **108** define a passageway **110** therebetween. Passageway **110** includes an implant cavity **112**, which defines a width dimension w_1 between rails **106**, **108** configured for the passage of at least a portion of spinal rod **10**. Passageway **110** has a uniform thickness. In some embodiments, all or only a portion of passageway **110** may have alternate cross section configurations, such as, for example, oval, oblong, triangular, square, polygonal, irregular, uniform, non-uniform, offset, staggered, and/or tapered.

In assembly, operation and use, system **20**, similar to the systems described above, is employed with a surgical procedure for treatment of a spinal disorder affecting a section of a spine of a patient, as shown in FIGS. **11-20**. For example, system **20** can be used with a surgical procedure for treatment of a condition or injury of an affected section of the spine including vertebrae **V**. System **20** may be employed with other surgical procedures, such as, for example, the systems and methods shown and described in U.S. Patent Application Publication No. 2008/0269805 to Dekutowski et al., the entire contents of which being hereby incorporated by reference herein. In some embodiments, system **20** may be employed with other surgical procedures, such as, for example, those described herein.

In use, to treat the affected section of vertebrae **V**, a medical practitioner obtains access to a surgical site including vertebrae **V** in any appropriate manner, such as through incision and retraction of tissues. In some embodiments, system **20** may be used in any existing surgical method or technique including open surgery, mini-open surgery, minimally invasive surgery including percutaneous surgical implantation, whereby vertebrae are accessed through a micro-incision, or sleeve that provides a protected passageway to the area. Once access to the surgical site is obtained, the particular surgical procedure is performed for treating the spinal disorder. The components of system **20** are employed to augment the surgical treatment. The components of system **20** can be delivered or implanted as a pre-assembled device or can be assembled in situ. One or all of the components of system **20** may be completely or partially revised, removed or replaced during or after the surgical procedure.

One or a plurality of incisions are made in the body of a patient and a cutting instrument (not shown) creates one or a plurality of surgical pathways and/or openings for implantation of components of system **20**. For example, system **20** is employed with a percutaneous surgical implantation such that a stab incision creates a surgical pathway for delivering a bone fastener, such as, for example, a pedicle screw **101** and/or spinal rod **10** to the surgical site. A preparation instrument (not shown) can be employed to prepare tissue surfaces of vertebrae **V**, as well as for aspiration and irrigation of a surgical region according to the requirements of a particular surgical application.

Pilot holes or the like are made in vertebrae **V** for receiving the shafts of pedicle screws **101**. Components of system **20** including extenders **100** are disposed adjacent vertebrae **V** at the surgical site and the components of system **20** are manipulable to fix or otherwise connect pedicle screws **101** with vertebrae **V**, according to the particular requirements of the surgical treatment. Pedicle screws **101** are fastened with vertebrae **V**. A driver (not shown) may be employed with extenders **100** to fix pedicle screws **101** with vertebrae **V**.

Jaws **236**, **246** are disposed adjacent spinal rod **10** and in a non-locking and open orientation, as described with regard to FIGS. **9** and **10**. From the non-locking orientation, release handle **278** is rotated for disposal in flush engagement with handle body **244**, as described. Latch **234** is rotated to the locking orientation such that shaft **224** axially translates relative to handle body **244** and sleeve **238** to close jaws **236**, **246** and capture spinal rod **10**. In one embodiment, spinal rod **10** is initially placed, inclined relative to extenders **100**, in the stab incision percutaneously and moved to the surgical site such that spinal rod **10** is inclined relative to extenders **100**.

In one embodiment, as shown in FIGS. **11-16**, a practitioner employs instrument **222** for insertion of spinal rod **10** through extenders **100** along a path that includes a distal and/or far location from the practitioner of the path corresponding to an adjacent pedicle screw **101a**, to a proximal and/or near location to the practitioner of the path corresponding to an adjacent pedicle screw **101c**. Spinal rod **10** is disposed with instrument **222** in the locking orientation, as shown in FIG. **11**.

The practitioner grips handle **244** to dispose a distal tip **15** of spinal rod **10** inside the window of extender **100a** and above the skin and fascia **S**, as shown in FIG. **12**. Instrument **222** orients spinal rod **10** such that an axis **a** of spinal rod **10** is offset an angle α from an axis **b** of extender **100a**. Angle α is disposed in a first plane, such as, for example, a sagittal plane **SP** of vertebrae **V**. In some embodiments, angle α is oriented in a cephalad-caudal orientation. In some embodiments, angle α may be oriented in planes, such as those described herein.

In some embodiments, instrument **222** orients spinal rod **10** such that axis **a** is offset an angle β from axis **b**. Angle β is disposed in a second plane, such as, for example, a transverse plane **TP** of vertebrae **V**. In some embodiments, angle β is oriented in a medial orientation and/or a lateral orientation. In some embodiments, angle β may be oriented in planes, such as those described herein. In some embodiments, instrument **222** is oriented at angle α and/or angle β to prevent handle body **244** from interfering with extenders **100**. In some embodiments, instrument **222** orients spinal rod **10** at angle α and angle β , disposed relative extender **100a**, to define a three dimensional angle, which is defined by a position in space of spinal rod **10** and the intersection of planes **SP**, **TP**.

15

With distal tip **15** disposed beneath the skin and fascia and adjacent extender **100a**, as shown in FIG. **14**, instrument **222** orients spinal rod **10** to simultaneously lower spinal rod **10** to the screw head of pedicle screw **101a** and rotate spinal rod **10** through extenders **100b**, **100c**, as shown in FIG. **15**. Instrument **222** orients spinal rod **10** to lower spinal rod **10** with the screw heads of pedicle screws **101b**, **101c**, as shown in FIG. **16**. Jaws **236**, **246** have a greater width dimension than the window of extender **100a** and are prevented from entering the window of extender **100a** and/or implant cavity **112**. In some embodiments, one or more of extenders **100** are configured for engagement with a reduction instrument, which is disposed for translation along passageway **110** to engage spinal rod **10** and reduce spinal rod **10** into the screw heads of the pedicle screws.

In one embodiment, as shown in FIGS. **17-20**, similar to the method described with regard to FIGS. **11-16**, a practitioner employs instrument **222** for insertion of spinal rod **10** through extenders **100** along a path that includes a proximal and/or near location to the practitioner of the path corresponding to an adjacent pedicle screw **101a**, to a distal and/or far location from the practitioner of the path corresponding to an adjacent pedicle screw **101c**. Spinal rod **10** is disposed with instrument **222** in the locking orientation, as described.

The practitioner grips handle **244** to dispose distal tip **15** inside the window of extender **100a** and within implant cavity **112**, as shown in FIG. **17**. Instrument **222** orients spinal rod **10**, similar to that described with regard to FIGS. **12** and **13**.

With distal tip **15** disposed beneath the skin and fascia and adjacent extender **100a**, as shown in FIG. **17**, instrument **222** orients spinal rod **10** to simultaneously lower spinal rod **10** to the screw head of pedicle screw **101a** and rotate spinal rod **10** through extenders **100b**, **100c**, as shown in FIG. **18**. Instrument **222** orients spinal rod **10** to lower spinal rod **10** with the screw heads of pedicle screws **101b**, **101c**. In some embodiments, the incision through which spinal rod **10** is inserted may need to be extended up to approximately 10 millimeters to accommodate the length of jaws **236**, **246**.

To release spinal rod **10** from jaws **236**, **246**, release handle **278** is rotated, in the direction shown by arrow N in FIG. **19**, to actuate collet release **268**. As release handle **278** is rotated, the surface of groove **292** slides along wedge **295** separating release handle **278** from handle body **244**, in the axial direction shown by arrow O in FIG. **20**. Lock **280** is drawn in the axial direction such that surface **287** is released from inner wall **289** such that latch **234** is rotatable relative to handle body **244** about pivot point **270**, as described herein.

Rotation of latch **234** to the non-locking orientation causes shaft **224** to axially translate relative to handle body **244** and sleeve **238**, as described herein. The axial translation of shaft **224** causes jaw **236** to separate from jaw **246** to release spinal rod **10** from capture. Spinal rod **10** is locked with pedicle screws **101** by coupling members, such as, for example, set screws. Instrument **222** and/or the non-implanted components of system **20** are removed from the surgical site and the incision is closed.

One or more of the components of system **20** can be made of radiolucent materials such as polymers. Radiomarkers may be included for identification under x-ray, fluoroscopy, CT or other imaging techniques. In some embodiments, the use of microsurgical and image guided technologies may be employed to access, view and repair spinal deterioration or damage, with the aid of system **20**.

16

In some embodiments, system **20** may include one or a plurality of spinal rods and/or bone fasteners for use with a single vertebral level or a plurality of vertebral levels. In some embodiments, the rods and/or bone fasteners may be engaged with vertebrae in various orientations, such as, for example, series, parallel, offset, staggered and/or alternate vertebral levels. In some embodiments, the bone fasteners may include one or a plurality of multi-axial screws, sagittal angulation screws, pedicle screws, mono-axial screws, uni-planar screws, fixed screws, tissue penetrating screws, conventional screws, expanding screws, anchors, buttons, connectors, clips, snaps, friction fittings, compressive fittings, expanding rivets, staples, nails, adhesives, fixation plates and/or posts. The spinal rods and/or bone fasteners may be coated with an osteoinductive or osteoconductive material to enhance fixation, and/or include one or a plurality of therapeutic agents.

In one embodiment, system **20** includes an agent, which may be disposed, packed, coated or layered within, on or about the components and/or surfaces of system **20**. In some embodiments, the agent may include bone growth promoting material, such as, for example, bone graft to enhance fixation of the fixation elements with vertebrae. In some embodiments, the agent may include one or a plurality of therapeutic agents and/or pharmacological agents for release, including sustained release, to treat, for example, pain, inflammation and degeneration.

In some embodiments, system **20** may include one or a plurality of inserters, extenders, reducers, bone fasteners, rods and/or other vertebral constructs, which may be alternately sized and dimensioned, and arranged as a kit, according to the requirements of a particular application.

It will be understood that various modifications may be made to the embodiments disclosed herein. Therefore, the above description should not be construed as limiting, but merely as exemplification of the various embodiments. Those skilled in the art will envision other modifications within the scope and spirit of the claims appended hereto.

What is claimed is:

1. A surgical instrument comprising:

a body;

a first member extending between a proximal end and a distal end;

a second member extending between a proximal end connected with the body and a distal end; and

a third member connected to the proximal end of the first member and the body to relatively axially translate the distal ends, the third member including a latch and a lock engageable with the latch,

wherein the latch is disposable in a locking orientation such that the distal ends engage a spinal construct and rotatable to a non-locking orientation such that the lock disengages the latch and the latch is biased relative to the body such that the distal ends are disposed to disengage the spinal construct, the distal end of the first member being distal to the distal end of the second member when the latch is in the non-locking orientation and the locking orientation.

2. A surgical instrument as recited in claim 1, wherein the third member includes an outer surface having a plurality of widths, the widths having an ergonomic configuration to facilitate manipulation thereof.

3. A surgical instrument as recited in claim 1, wherein the latch is connected with the body at a pivot point such that the latch is rotatable about the pivot point.

17

4. A surgical instrument as recited in claim 1, wherein the latch defines a slot configured for disposal of the proximal end of the first member.

5. A surgical instrument as recited in claim 4, wherein the slot defines a first movable limit and a second movable limit for the proximal end of the first member.

6. A surgical instrument as recited in claim 1, wherein the latch is biased outwardly from the body to the non-locking orientation.

7. A surgical instrument as recited in claim 1, wherein the latch is manipulable from the non-locking orientation to translate the first member relative to the second member.

8. A surgical instrument as recited in claim 1, wherein the lock is resiliently biased to a locking orientation to prevent movement of the latch.

9. A surgical instrument as recited in claim 1, wherein the lock is movable between a locking orientation to prevent movement of the latch and a non-locking orientation such that the latch is movable relative to the body.

10. A surgical instrument as recited in claim 1, wherein the third member is angled between 10 and 80 degrees relative to the first and second members such that in the locking orientation, the third member is substantially non-parallel and non-perpendicular with an extender.

11. A surgical instrument as recited in claim 1, wherein the third member is manipulable such that a force oriented in a first direction is applied to the third member and a force oriented in a second opposing direction is applied to the third member to release the latch.

12. A surgical instrument as recited in claim 1, wherein the lock defines an inclined ramp engageable with the latch to facilitate movement of the latch from the locking orientation to the non-locking orientation.

13. A surgical instrument as recited in claim 1, further comprising a part that engages the second member, the part being rotatably coupled to the body and configured to translate the second member relative to the body upon rotation of the part relative to the body.

14. A surgical implant system comprising:

a surgical instrument comprising:

a body;

a first member extending between a proximal end and a distal end comprising a first jaw;

a second member extending between a proximal end connected with the body and a distal end comprising a second jaw; and

a third member connected to the proximal end of the first member and the body to axially translate the first jaw relative to the second jaw, the third member including a latch and a lock engageable with the latch;

a spinal rod,

wherein the latch is disposable in a locking orientation such that inner surfaces of the jaws engage the spinal rod and rotatable to a non-locking orientation such that the lock disengages the latch and the latch is biased relative to the body such that the jaws are disposed to disengage the spinal rod, the first jaw being distal to the

18

second jaw when the latch is in the non-locking orientation and the locking orientation; and
an extender including a first wall and a second wall, the walls defining an implant cavity therebetween, the implant cavity defining a first width dimension between the walls.

15. A surgical implant system as recited in claim 14, wherein the distal end of the second member includes a second width dimension greater than the first width dimension to prevent disposal of the distal end of the second member within the implant cavity.

16. A surgical instrument as recited in claim 14, wherein the lock is movable between a locking orientation to prevent movement of the latch and a non-locking orientation such that the latch is movable relative to the body.

17. A surgical implant system as recited in claim 14, wherein the second member defines a longitudinal axis, the inner surfaces being spaced apart a first distance along the longitudinal axis when the latch is in the locking orientation and a second distance along the longitudinal axis when the latch is in the non-locking orientation, the second distance being greater than the first distance.

18. A surgical instrument comprising:

a body;

a first member extending between a first end and a second end;

a second member extending between a first end connected with the body and a second end; and

a third member connected to the first end of the first member and the body to relatively axially translate the second ends, the third member including a latch and a lock engageable with the latch, the latch comprising a slot having a first movable limit and a second movable limit,

wherein the latch is disposable in a locking orientation such that the second ends engage a spinal construct and rotatable to a non-locking orientation such that the lock disengages the latch and the latch is biased relative to the body such that the second ends are disposed to disengage the spinal construct, and

wherein the first end of the first member comprises a bead positioned in the slot, the bead moving from the first movable limit to the second movable limit as the latch moves from the non-locking orientation to the locking orientation.

19. A surgical instrument as recited in claim 18, wherein the bead is positioned adjacent to the first movable limit when the latch is in the non-locking orientation and the bead is positioned adjacent to the second movable limit when the latch is in the locking orientation.

20. A surgical instrument as recited in claim 18, wherein the second end of the first member comprises a first jaw and the second end of the second member comprises a second jaw, the first jaw being distal to the second jaw when the latch is in the non-locking orientation and the locking orientation.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 9,554,835 B2
APPLICATION NO. : 13/827485
DATED : January 31, 2017
INVENTOR(S) : Brinkman et al.

Page 1 of 1

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

On the Title Page

On Page 2, in item (56), under "U.S. PATENT DOCUMENTS", in Column 1, Line 21, delete "Justis et al." and insert -- Justis --, therefor.

On Page 2, in item (56), under "U.S. PATENT DOCUMENTS", in Column 2, Line 12, delete "McLean" and insert -- McLean et al. --, therefor.

In the Specification

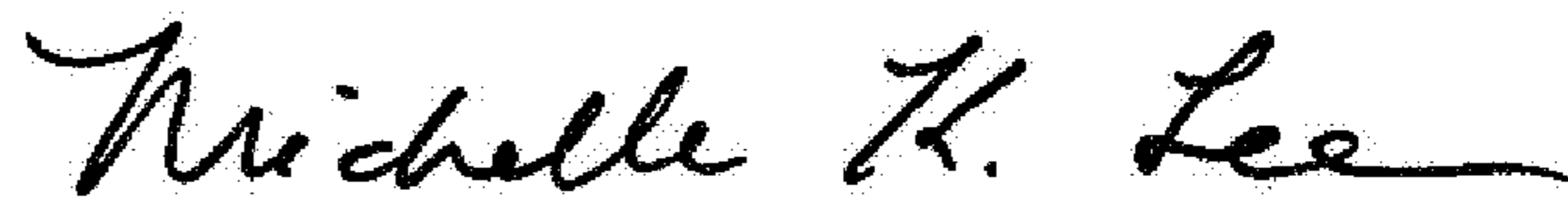
In Column 13, Line 46, delete "Dekutowski" and insert -- Dekutoski --, therefor.

In the Claims

In Column 18, Line 12, in Claim 16, delete "surgical instrument" and insert -- surgical implant system --, therefor.

In Column 18, Line 47, in Claim 19, delete "fist" and insert -- first --, therefor.

Signed and Sealed this
Second Day of May, 2017



Michelle K. Lee
Director of the United States Patent and Trademark Office